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PUBLIC ELECTRIC LIGHTING IN NEW YORK CITY.

The Board of Aldermen of this city appears to have been attacked with an economical spasm, but we have grave fears that the usual remedies, or those heretofore administered on previous similar occasions, will be applied in sufficient time to counteract all danger of the said spasm becoming permanently seated. Indeed it may be confidently asserted that "the Board's economical colic" will never reach the chronic stage—and more's the pity. In view of that diagnosis it is not to be supposed that anything accruing to the relief of our metropolitan taxpayers will ever come out of the preamble and resolution submitted (at Board meeting of Nov. 17th) by Alderman Hartman for the consideration of his colleagues. This document was as follows:

Whereas, It appears, from the departmental estimate of the Commissioner of Public Works, that if the proposed substitution of 2,062 electric lights, at an estimated cost of $526,841, for 5,135 gas lights, estimated to cost $89,862.50 is carried into effect, as requested by certain resolutions of the Common Council, heretofore passed, the city will certainly lose the sum of $436,978.50 each year; and

Whereas, When it is considered that, in addition to the greatly enhanced cost of electric lights, the streets and highways are incumbered by unsightly wooden poles from which are suspended wires that obstruct the streets, impede the work of the firemen in extinguishing conflagrations, and menace the lives of persons brought into contact with them when charged with the electric current—several deaths having already occurred from this cause—it is evident that lighting the streets of this city by gas is far more economical and less dangerous than if lighted by electricity; be it therefore

Resolved, That the Commissioners for lighting the city, viz.: the Commissioner of Public Works, in conjunction with the Mayor and Controller, be and they are hereby authorized and directed to discontinue the use of electricity in lighting the public streets of this city when the existing contracts therefor shall have terminated, and immediately where no such contract exists, and that thereafter no public street, avenue, highway, or public place, except the front of the city and public parks, shall be lighted by electric lights at the expense of the corporation of the city of New York." The matter was referred to Committee on Streets.

Now, it would appear from the above as though Ald. Hartman had made out a pretty good case against the electric lighting of the city's streets; but it would seem equally clear that he convicts "the Board" of either imbecility or knavery—possibly of both, since its membership may, without any great stretch of imagination, be supposed to contain a fair sprinkling of each sort. "The Board" knew very well—when it was at divers times so lavish in passing resolutions authorizing the erection and maintenance of electric lights at certain points—what such lights would cost the city; and it was also its business to be conversant with the cost of the gas lights which were to be displaced. Still, things of so trifling a nature are not to be seriously considered by "an alderman;" and we must confess that the portion of the resolution "directing" the Gas Commission to forbear from future renewal of existing electric lighting contracts is ridiculous in the extreme; and ridiculous simply on account of the tender relations involved (by at least one member of that body) between it and the electrical promoters. Our highly belauded reformer-Mayor, Mr. Wm. H. Grace, was "at one time" an ardent believer in the virtues of arc electric lighting, and believed in it to such a degree as to cause him to become an investor in the shares of one or more of

the electrical companies formed in this city some three or four years ago. We should not wonder if he were a shareholder still; and on the presumption that such is the case, "Gas Commissioner Grace" would quite naturally not wish to "stand in the light" of "electrical investor Grace." By no means; but would rather believe in lighting the city (electrically) well, even if the price of each arc furnished does amount to the round sum of $255.50 annually. This supposition opens up the possibility that certain members of the aldermanic body are in opposition to our reformer-Mayor, and would thus basely seek to interfere with the profitableness of his "electric" shareholdings. On the other hand, of course, appears the well-known inclination of our city fathers to "turn an honest penny" on every possible occasion; and their financial scent may have been quickened somewhat by the intimation that the local Brush Company declared a dividend on its shares during last November. In either case, whether they seek to "wing" the Mayor or "earn the penny," in so far as our attempting to find a motive for Alderman Hartman's action is concerned, we submit that but little hope is held out for comforting assurance on the part of the taxpayer.

It is a mistake to suppose that the gas companies of New York city are over-anxious for the securing of the city's street lighting at the prices at present paid. A schedule of 4,000 hours, with burners consuming in excess of the stipulated quantity, is recompensed at the rate of $17.50 per lamp per annum—and one company (the Equitable) is in fact supplying the lamps located along its mains at an annual charge of but $12. Those conversant with the conditions of gas manufacture and distribution in New York city will at once concede that money must be lost (in this latter case) to the purveyors if the stipulations of the contract are faithfully carried out. But while the authorities are so exacting with the gas companies, witness their prodigality to the electrical promoters.

At the present time there are 703 public arc lights maintained by the municipality, at a total cost of $179,616.50; and these arcs displace 3,210 gas lamps, the former total cost of same being but $56,175. No doubt it is true the light afforded by the arcs is greater than the volume formerly supplied by the displaced gas lamps; but he who would claim that (were the amounts expended for electricity and gas equal in sum) the city was more efficiently illuminated by the former than by the latter lighting agent, could certainly be looked upon as a possible owner of electric lighting shares. Perhaps the 1886 Board will be less favorably disposed toward the electrical promoters than was its predecessor; but we incline to the idea that relief may not be looked for in that direction.

FRIEND HARBISON WAS "JUSTIFIED."

Mr. Jno. P. Harbison, of the Hartford (Conn.) Gas Light Company, had quite a unique experience recently, and in view of the peculiar circumstances attending the case we herewith present a summary of the same. Mr. H., as previously reported in the JOURNAL, has been engaged in making alterations to the mains of the Hartford Company, and has been watching the work pretty closely. Towards dusk on one evening in November a gang of pipe layers were about finishing a particularly nice piece of main substitution, when a slight accident occurred in the handling of the pipe that momentarily allowed of the escape of a large volume of gas. Mr. Harbison was close by when the event happened, but before he could reach the exact spot of difficulty the usual crowd of loungers had closed in about the place. Pushing his way through he had gained the edge of the trench, when he noticed an onlooker peering into the cut and calmly smoking a pipe. Mr. Harbison shouted to the fellow (his name is Corcoran), "Stand back; there is danger in that pipe;" and failing to do as requested, Mr. H. shoved the offender down the trench bank. Corcoran immediately struck out at the gas man, and probably had cause to repent of his action, as the Hartford Company's Treasurer speedily "sent him to grass." Mr. Harbison instructed a police officer to arrest Corcoran, and that worthy was conveyed to the lock-up. Next morning Mr. H. appeared in court to make a charge of assault against Corcoran, and was rather surprised to find himself placed in the position of being called upon to answer a similar charge preferred by Corcoran. When the testimony on both sides had been given the Court decided, "It was clear Mr. Harbison was not to blame in the premises. His conduct was in the interest of everyone concerned in the repairs to the pipes, and in that of the people who had to pass the place. He interfered, with more or less violence, to prevent an accident. The justification of Mr. Harbison's act inhered in the fact that there was danger, and his course was undoubtedly in Corcoran's interest as well as in the interest of others."

Mr. Harbison not caring to press the charge against Corcoran that offender was discharged. Superintendents of gas companies might do well to "post" their men in regard to this decision.

RECEIPTS OF THE NOVELTIES EXHIBITION.—Mr. H. R. Heyl, of the Board of Managers of the Franklin Institute, reports that 145,000 persons visited the "Novelties." The gross receipts were $43,000.

[OFFICIAL REPORT—Continued from page 260.]

Thirteenth Annual Meeting of the American Gas Light Association.

HELD AT COLLEGE HALL, CINCINNATI, OHIO, OCT. 21, 22, 23.

FIRST DAY—AFTERNOON SESSION.—WEDNESDAY, OCT. 21.

The next paper read was that presented by Mr. W. H. Denniston, Supt. of the East End Gas Light Company, of Pittsburgh, Pa. It bore the title of

NATURAL GAS,

and is as follows:

There is no apology necessary, and so none is offered, for the writing of this paper. The reason for its preparation, shortly and simply stated, is that I was asked by our Secretary to prepare an article on the subject of "Natural Gas," and I returned him an affirmative answer. If the choice of subjects had been left with me, this one would not have been selected; but I have undertaken it in the hope that a short article, of modest pretension, as to experience with, or knowledge of, the subject, would open up a discussion on the question, so that others who are more able, and have had greater experience in the premises, might debate the various phases regarding its utility (also the probable results), and the likelihood of its becoming a competitor with coal gas as an illuminating or fuel agent.

I remember at our last meeting one of our members thought the subject hardly worth discussing, because of the limited extent of territory where natural gas was to be found, and because the prospect of its approaching to anything like an important competitor of coal gas was too remote.

Since that meeting there has been a regular boom in natural gas. Within the past few months large sums of money have been expended in developing gas territory, and even in "wild catting" and prospecting. Of course, it is known that natural gas had been found in a great many places—indeed nearly all over the world; also that in many of the States and Territories, and in Canada it had been discovered in paying volumes, and utilized in salt manufacturing operations, and as fuel for steam boilers, etc. Ten years ago, or when I was interested in producing oil, I remember how pleased we were to obtain from one of the wells a strong flow of gas. It was used under several boilers at first; then, as the pressure weakened, a fuel supply for only one boiler could be obtained; and finally we had again to return to the use of coal. In very many places, therefore, it was known and used to a limited extent; but this present general utilization of natural gas is of quite recent growth. In my own immediate neighborhood (Pittsburgh, Pa.) where a short time ago the capital invested was counted by thousands, and where it had been in use to some extent for years, there are now millions of dollars in the business, with a prospect of millions more being put out in the same direction before the maximum of such ventures will be reached. We can better realize the immensity of this business in and around Pittsburgh by means of comparison. Take a single manufacturing establishment that had been buying—not a single car load of coal—but the contents of an entire train of 50 or 60 coal-laden cars every day in the week. The cessation of that single purchaser would in itself materially curtail the output of some of our largest mines; but that single stoppage is a "mere bagatelle." Imagine, if you can, a great city with its wealth centered in its manufacturing establishments—many of them gigantic in their proportions—and picture all, or nearly all, of these immense establishments employing natural gas for fuel where formerly coal alone was used, and you may form some idea of the magnitude of the revolution in heating methods. Why, there is a single corporation, only a few months old, whose capital is now between four and five millions of dollars; and it would require the foresight of an Elijah to predict what its capital may be one year hence. That corporation is now selling at the rate of 1½ to 2 millions dollars worth of gas per annum, and is then not disposing of its entire product. Computed at the same rate as that sold, nearly another million dollars' worth goes to waste.

But this natural gas industry or field of production is not confined to Pittsburgh and vicinity. As I have said, it has been found in nearly all parts of the globe; and, therefore, as there "is no telling where lightning may strike," so also is there no predicting where the next gusher will be found. Indeed, who will say, judging the future by the past and present, that ere long Western Pennsylvania may not be piping fuel to the metropolis, and Eastern Ohio—supplying Chicago and the West with a cheap substitute for corn-cob fires!

Well, when found what is it? It is as different as the different grades of petroleum or rock oil. In some places the illuminating qualities of the gas are placed at 10 to 12-candle power, when used in ordinary burners. In the vicinity of Pittsburgh—especially the Murraysville gas—the illuminating value is of only about 8-candle power. In its crude state it affords a very good fuel medium, but it is a poor illuminator.

Nearly two years ago, or when the first natural gas pipes were laid within our city limits, and in our "East End" district, I had a pipe run to the gas

works, and endeavored to make an illuminating gas out of the natura product. I succeeded, too.

Now, I am not a chemist, nor do I claim to be an expert gas engineer; but, for a short time, I had the valuable assistance of Messrs. Robert Young, of Allegheny City, and J. H. McElroy, of the old Pittsburgh gas works. You all know who and what they are, and are conversant with the fact that they are not novices in our business.

The only experiments of which I have personal knowledge were those made by the aid of the crude apparatus then at hand. The gentlemen named have since made more extensive and more careful investigations; but the result originally reached was that the product from the wells in the Murraysville neighborhood was almost a pure marsh gas, having about 8-candle power. It needed no purification, and was almost odorless. Heating it made no difference in its quality. We passed it through small pipe and large pipe; through iron and through clay pipe. Under high heats and low heats it was still, comparatively, the same. Then we used rich coal gas, petroleum—crude and refined—also gasoline and benzine as enrichers, and made gas of different grades—that is, it differed in its illuminating qualities—but, everything considered, it was an unsatisfactory substitute for coal gas as an illuminating agent. The experiments, though, were well worth the trouble and expense to which we had been put, for we felt that natural gas would not immediately destroy the coal gas interests, whatever might be the result in the unknown future.

We did not claim all the wisdom in the world, or that we had exhausted every device for gaining the end sought, and we did not assert that something would *not* be forthcoming to make it an active competitor; but we felt easy, at the time, as to our coal gas investments, although it was even then apparent that natural gas would soon be the fuel for the mills.

We found that the kind of burner used would make a difference as to the amount of light afforded by a given quantity; also, that, if there were too large a quantity of the naphtha enricher used, the gas would smoke; if not enough, a blue flame was the result. In either case the gas was unsatisfactory. It was next to impossible to regulate it so as to ensure a steady or unvarying quality of illumination—indeed, at times, there is a decided variation in the composition of the gas that issues from the same well. While this experimenting above noted was going on—you may believe it or not—my position was far from being a "happy one." All along the line there was a howl about poor gas, just as soon as it became known that experiments with natural gas were being made. It was some months after it had been entirely cut off before I could convince our customers that I was selling them coal gas.

It was not so much the quality that caused the dissatisfaction, but rather the idea that I was still sending out natural gas and selling it to them (mixed with benzine) at coal gas prices. I challenged tests; I told them they were getting good 17-candle power coal gas. The experiment had a most demoralizing effect, and I do not now know that our company has entirely recovered from it yet, although during the past year we have thrown a "sprat to the whale" in the shape of a 20 per cent. reduction from the price then charged.

Since the time I speak of "companies and companies" have been formed; private parties have invested and speculated; individuals and companies have been bought out, and combinations have been effected. The territory of Messrs. McElroy and Young has been invaded, and they have sought to and do control, at least to a large degree, what at first seemed to be an influential competitor. Now gas of both sorts—for lighting and heating—is being delivered by them to the same class of customers, through different main systems, of course. They at last seem to be satisfied that natural gas has come to stay for some time, and so have made their preparations accordingly. In other localities where natural gas has been found and utilized, in nearly every instance a diminution of the supply has been observed. This is especially the case at East Liverpool, Ohio; Erie, Pa., and throughout the oil territory of Northwestern Pennsylvania, and even at Sharpsburgh, near Pittsburgh, as well as at other places of lesser note. Like the great oil pools, the end may come, and in the same way.

The supply around Pittsburgh now seems inexhaustible, and it is found on all sides of the city—to the north, south, east, and west. Whether it is inexhaustible or not is the problem now in process of solution. The oil supply in the most wonderfully prolific districts did dwindle down to "nil." The gas output may follow the same course. The gas-containing strata developed in different ages of the world's formation may not have sufficient capacity for storage of an indefinite supply, and the manufacturing facilities "down below" may not be equal to the demand. What causes it? Why is it found in certain localities and not in others? Is it of animal or vegetable origin? Or is it of animal origin in one place, and vegetable or a compound of both sorts at another place? These are all questions upon which there are held all sorts and varieties of opinions. This fact, however, remains—those of us interested in coal and coal gas, who are residents of the natural gas bearing sections of the country, need to learn all we can about this very subject.

Already parties are claiming that plans have been perfected which will insure its use for illumination as universally as it is now being employed as a fuel. It is a menace to the coal gas interests. Whether or not it will injure such interests to a greater extent than has been done by water gas, electricity, or other lighting methods, no one can foretell with certainty. If made a success as an illuminant, there is no good reason why the coal gas companies should not employ it in connection with their present plant, for the reason that a large proportion of their capital is invested in street mains, and changes can be easily and cheaply made in our distribution systems if found desirable to supply natural gas either in part or in whole.

The pressure at which the gas is delivered in the city of Pittsburgh will soon be regulated by means of high and low pressure pipes. The large or delivery mains from the wells will be maintained at heavy pressure, while the mains for tapping and distributing the output to consumers will be carried at low pressure.

I have used natural gas as fuel under the retorts, and found it a good substitute for coke. I only used it when there was a demand for all the coke made. I then paid (for a quantity of gas equal in fuel effect to the coke that would have been used) a sum equal to what the coke would have been worth in the yard. In that way I supplied my coke customers, and used their money in turn to pay for our fuel gas.

Since writing the above I mentioned to a friend that I had prepared a short article on the subject of "Natural Gas," which was to be read at the next meeting of the Association. He in turn asked me what I thought of Emerson McMillin's article on that subject. I had to plead ignorance, because I had been away from home at the time that paper was published in the American Gas Light Journal. On my return I did not have time enough to spare even to read the daily papers; so I did not hunt up the Journal which contained the paper mentioned until last Sunday. On that day I looked it up and read it over carefully. It furnished me with excellent Sunday reading. Our Secretary knew of that paper, and I can hardly understand why he should have asked me to dilate upon the theme after Mr. McMillin had handled it so carefully. I would recommend those who have not seen the McMillin article to get a copy of the Journal (date of August 17, 1885,) and read it. They will find a vast deal of information on this subject that is presented in a most interesting manner. I know the difficulty experienced in inducing members to prepare papers to be read and discussed at our annual meetings; and while I would have preferred that someone else had been called upon to formally present this question, I feel that I have only performed a duty in complying with the request of the Secretary. I leave it with the Association to decide whether or not the matter presented by me is worth their discussion.

Discussion.

Mr. Denniston—In the paper I have made some facetious remarks about piping gas to the Metropolis and to Chicago. While reading the newspapers yesterday I noticed that a proposition had been mooted by capitalists to convey natural gas in pipes to the seaboard; so that although I have referred to the project in a humorous way, there may be really more in it than we now anticipate.

The President—This is a very interesting subject to all of us, and I hope the paper will meet with a full discussion. Perhaps some of the members would like to ask Mr. Denniston some questions. He is is no doubt prepared to answer them.

Mr. Wood—Does Mr. Denniston know whether they are using natural gas in the gas works at East Liverpool, Ohio?

Mr. Denniston—Yes, they are; but the supply has diminished quite perceptibly. Some years ago, you will remember, they started a coal gas works there. Afterward they used the natural gas; and they have carbonized no coal for a long time. I understood from the man in charge that the supply of natural gas was becoming so limited that perhaps they would have to return to the use of coal again.

Mr. Wood—What was the pressure at East Liverpool?

Mr. Denniston—I cannot state; I know, however, that it varies (in the Pittsburgh, Butler, and Venango districts) from 5 to 500 pounds. It has been diminishing rapidly in the immediate neighborhood of Pittsburgh. The wells struck in my own district at first had quite a strong pressure, but it has been diminishing. They do not pretend to rely upon them now for a supply, but are bringing the gas from points further south, or where the pressure is from 50 to 300 pounds. They are now laying 12 to 15 miles of 24-inch pipe to wells where at first they had but a 6 or 8-inch pipe, in order to supply what is now needed for the mills about the city. The Consolidated Company referred to in the paper has between 250 and 300 miles of pipe laid in and about Pittsburgh. There are probably 500 miles of pipe in the neighborhood of Pittsburgh at the present time—all intended (and needed) to furnish the supply of natural gas.

The President—What is the amount of natural gas distributed per day in Pittsburgh, estimating by the amount of coal displaced?

Mr. Denniston—I asked for some data about that, but am not sure that I have it. I can only tell you they are distributing now to about 50 glass works and say fifteen hundred private consumers in the two cities. The demand is constantly increasing. They cannot begin to hire the requisite labor for the necessary work of fitting the houses for the supply of fuel gas. I am speaking now of private houses in which the gas is to be employed for cooking and heating. I was told that this Consolidated Company had outstanding contracts approaching an annual value of 1½ millions of dollars. This sum, of course, included all gas supplied. In supplying the gas for fuel and heat they use a special cut-off valve. As you are aware, the gas flow ceases—momentarily, it may be—and then goes on again. That peculiarity would make its use as a domestic fuel very dangerous. It is easy to imagine what the result might be, under the circumstances, in the case of a heating or cook stove. They have a valve so arranged that when the supply stops no gas can enter the building till one goes outside and turns it on again. In that way they claim to obviate what was a very serious objection. I am asked a question as to the amount of coal displaced. I am told, in making contracts, they make a reduction from the price of lump coal of from 10 to 20 per cent., depending upon the amount consumed, the method of consumption, etc.

The President—I saw a statement to the effect that the displacement is equal to 10,000 tons of coal per day.

Mr. Denniston—I think the amount of coal supposed to be so displaced in Pittsburgh, as near as we can judge, is not far from 10,000 tons per day. Nearly all the manufacturing concerns are using it—that is, those who can get it. They do not use any coal where they can get the gas. There are pipes sticking up and flaming all about our city, and the place is illuminated at night by the flame from gas pipes so standing up in the air. In addition, along many lines of pipe, the people out in the country are using the gas (where it is escaping from the pipes) for heating and cooking.

The President—What arrangement do they make in private houses for the use of the gas? Do they have to change the ranges? Does it displace all other fuel in private houses?

Mr. Denniston—Yes. I have it in my own house. It is run in through a separate pipe. Of course, there is an entirely separate plant, mains and services. It is run into the house something like the ordinary coal gas service; and then the pipes are run up through the flues of the building. The pipes are not run around the walls nor under the laths; they do not want to put them in in such way; but they use your flues to place the pipes in them. For instance: In an eight-room house, four rooms above and four below, they run the pipe up through the flues from below, bringing it over the cellar to the flue, and bringing it out at the grate on both the first and second floors of the house. It goes up from the cellar into the flue, and comes out at the grates. Of course, the pipes can be run under the floor or around the room, but they prefer not to do so, because they do not think it is as safe. In their way of arranging the pipes should there be any escape of gas, by reason of displacement of the joints, or from any other cause, the escape goes into the flue, and is carried to the outside.

Mr. Leach—What do they charge for gas, and how do they estimate the quantity consumed? I judge that they do not meter it.

Mr. Denniston—They started out with meters, but some of those with whom I conversed thought it better not to have meters. As long as they had such an enormous supply I advised that no meters be used, but supply the consumer with all he wanted; that when the supply decreased, then would be time enough to resort to measuring. The meters, as a rule, have been removed; but in some places they are still in use. Some of the smaller companies on the south side use meters; and in that case they sell the gas for ten cents per thousand cubic feet. They started out on a basis of 50 cents, but now make their contracts according to size of house supplied. They have a maximum and a minimum price for a certain size of house; and they will supply you with all you want for the maximum price. Suppose you could, by economy, get along with $50 worth of gas per year, but that if you turned it on and used it generously you might take up $75 worth—they will charge you $75 for the supply, and you can use it or not. If you do not use it, they have the maximum amount anyhow; so that they are safe in that event. I do not believe the natural gas sold in Pittsburgh today would average over three cents per thousand feet if sold by meter. It seems pretty low, but there is a vast quantity also that is wasted. When (as the result of a diminished output) meters will be employed to register the quantities consumed, I think we will witness far greater economy in its use.

Mr. Harbison—This natural gas topic is a most interesting one to us, whether discussed in Pittsburgh or at the meetings of this Association. I have been a greatly interested listener to what Mr. Denniston said in his paper, and also to the remarks made by him in the discussion. The practical question for us is, "In what way can we reap some benefit in our cities from the use of this wonderful natural gas?" I was particularly impressed by a statement that a company had been organized for conveying the gas to the seaboard. I wish the company might continue its effort and solve the problem of carrying it to some of our inland towns. The greatest practical question with us now is, "What does our gas cost in the holder?" And in view of that it would seem pertinent to inquire why not use meters in the supplying of natural gas at Pittsburgh. Would not that plan check the waste complained of, and permit of diverting the surplus to those cities and towns not on the lines of the gas bearing territory? Once brought to such unfavored locations, the conveyors of same could sell their "gassy merchandise" to the local gas companies; and these latter might carburet or enrich it up to an illuminating power of 17 or 18 candles, and distribute the same to their consumers. Why cannot this be done with profit to the companies controlling the natural gas supply, and why would it not insure a great saving to the gas companies that would buy it? Perhaps it would enable the gas companies of New England particularly (for they are a conscientious people) to bring the selling price of 17 or 18 candle gas down to $1 per thousand cubic feet! This is the point that all New England gas men have in their minds—$1 per thousand cubic feet. We do not wish to receive a higher price than that for our gas if, by selling it at that price, we can pay a sufficient dividend to our stockholders. New England shareholders are not very exacting. They are satisfied with a return of anywhere from 8 to 20 per cent. per annum. If we can obtain this natural gas so much cheaper than we can make gas from coal, it will enable us to reach the dollar figure, and thus clean out all oil lamps and electric lights, and yet sell our gas at a profit. I wish Mr. Denniston would suggest to the gentlemen who have organized a company for the purpose of carrying the natural gas to the seaboard that they should not forget the New England towns. Give us some of the gas that is now going to waste at what, to them, would be a remunerative profit, and thus enable us, after paying fair living salaries to our managers and employees, to get our gas down to the dollar mark and still return a sufficient compensation to the stockholders. I believe that will be a movement in the right direction. I have seen the natural gas burned in Bradford, Pa., for lighting and heating, and I have heard of it in Pittsburgh. While I have not seen it there yet, I have seen in that city the pipes through which it was being conveyed; and I may add that one pipe went through the gas works. I will not say there was an outlet from it to the gas works; but the pipe entered their premises. They had a pretty strong pressure there, and I thought if that pipe were connected with our Hartford holders I would not be in any danger of leaving the city without a supply of gas, however dark the nights might be. If I could get the gas into our holders, under sufficient pressure, I would not care particularly about regenerative furnaces, enlarged retort house room, or anything of that sort. I do wish some practical idea of that kind may be carried out. I hope Brother Denniston will not stop where he is, but will try to see whether something cannot be done in the direction indicated. We could then sell our coke much more easily, as we would not make so much, and would get better prices for what we did make—which would help us out on our residual account. I think in Connecticut we should have to bore pretty deeply before striking a natural gas vein. I do not think, if we bored in the vicinity of Boston, we could strike a natural gas vein there that would raise our holders, or our hopes, very high.

Mr. McElroy—I made a two-inch pipe connection to supply natural gas to our holder; but, as Mr. Denniston says, the consumers can tell it just as soon as it is sent out. As quickly as one per cent. of natural gas was mixed with the coal gas the consumers observed the change. A mixture of natural gas and coal gas affords such a light body that it will not hold the flame; the least puff of wind will blow it out. We used a very small percentage of natural gas, enriched to proper degree, in mixture with our coal gas, and then found that our street lamps would become extinguished during stormy nights. As a consequence I took out the pipe which Mr. Harbison thinks would be of such advantage to him; and do not now use a foot of natural gas, nor a particle of oil. I have not done so for over a year. Of course, like all the others, I desired to see what was in it. I was deeply interested in making the experiment; and on its termination came to the conclusion there was no money in it. We found, when enriched to the proper standard, that it cost us more than we could put coal gas in the holder at. I would not take it as a gift and make illuminating gas from it.

Mr. Helme—How did you regulate the pressure?

Mr. McElroy—For private consumers we had what is called a "suspension valve," which will only permit of a certain pressure from the main. At that time it was the only way of supplying it. The valve would furnish the pressure to which it was adjusted. If the gas were shut off—as, for instance, during repairs in the streets, etc.—that valve cuts off the supply, which cannot be renewed until the pressure is restored, when the valve reopens. This, of course, limits the danger of explosion. With the low pressure main, as at present employed in Allegheny and Pittsburgh, a small opening controls the valve so as to keep the pressure in the city at a uniform rate. Practically natural gas is inodorous. It does possess a slight and peculiar scent; but as it issues from the wells the odor given off would be a poor guide to the

source of emission. They are now taking extreme precautions in the laying of pipes. The pipe joints are made with a ring surrounded by broken stone; that is covered with tarred paper which leads up to a funnel, and the funnel goes to the sidewalk. At these funnels you may "smell for it" or "light for it," and so detect leakages. If there is a leak we can tell whether it is in a main pipe or at a joint; and whether it is the manufactured or natural gas that is escaping. We can always tell our gas from the natural. One trouble is they are constantly digging up our streets and breaking our mains while laying their pipes. I think natural gas has been of great benefit to Pittsburgh, although it has ruined our coke and coal trade. Men who were retailing 13 or 14 car loads of coal per day do not now retail one. Formerly I could sell all my coke at home; now I cannot sell one-tenth part of it. I have either to give it away or throw it into the river. The quantity of natural gas which is now being used in Pittsburgh is incalculable. A six-inch pipe will deliver 14,000,000 cubic feet per day. I suppose there are 10 ten-inch pipes; 24 six-inch pipes, and 10 or 12 eight-inch pipes, all leading into Pittsburgh. The 24-inch pipe spoken of by Mr. Denniston is not yet finished. It is being laid by a Philadelphia company. Just as soon as that is down they intend to duplicate it; and then the facilities will not be large enough. When the mills stop the valve lifts and the gas flows off. Two or three injunctions have been served to stop that practice. The people would not stand the noise or heat in summer. The gas must be allowed to escape somewhere. One man ran his escape into the river, and the boys inquired why "the water was blowing up so high."

Mr. Harbison—Has the sale of natural gas reduced the sale of your coal gas?

Mr. McElroy—No; we are increasing our output rapidly. A proposition has been made to us by which the proposers agreed to put the natural gas into our holders at a cheaper rate than we can place coal gas in them. They have not yet succeeded in doing it.

Mr. Howard—Do they use the gas under low pressure in manufacturing establishments?

Mr. McElroy—No; as Mr. Denniston says, they are very careless in economizing the gas. Sometimes the high pressure fractures the pipes and curtails the delivery; and, consequently, those who require a very high pressure have to quit, while those who can run at very low pressure continue. There is one manufacturer there who can run under a four-inch pressure. He can run all the time; others cannot. The use of this gas saves from 8 to 10 per cent. in the oxidation of material. If there is any impurity in the iron, such as phosphorus or sulphate, it is burned out. It makes a better iron out of the same stock than coal does. Our flint glass men were formerly obliged to use covered pots—which were very costly—because they could not make that material without protecting it from the fumes of the fire. Now they are making it in tanks. They build a long tank right over the furnace, into which every man dips. In that way one blower does not get ahead of another. The men are enabled to turn out 50 per cent. more glass With a coal fire if a workman was "blowing" any article he had to quit and go home as soon as his pot was burned out. Now they can all work till the tank is empty.

Mr. Clark—I would like to know what percentage of enricher is used in carbureting the natural gas to 16 or 17 candle power. Also, how natural gas compares with water gas as a diluent.

Mr. Denniston—I cannot reply to the latter question, as I have had no experience with water gas. I can answer you, however, about the other. As I recollect it—taking the gas from Mr. Young's works—the proportion necessary to produce a gas of 18 to 20 candle power was 600 parts coal gas, 300 parts natural gas, and 100 parts benzine or naphtha. The results given are those obtained two years ago; I do not know what has been done since. We found that mixture would make a very good light. Could we have kept it constantly at that grade it would have afforded a satisfactory light to the consumers; but, as Mr. McElroy remarked, there was no economy in that kind of gas. We found we might as well make coal gas as to be bothered with the mixing process. Even though we got the natural gas for nothing, the expense of working it up made it equal, in the end, to the cost of the coal gas. Whenever it comes to the point that you can get natural gas at a price to compete with coal gas, and so that you can make both fuel and light out of it, then you may have reason to fear it. Till that time I do not fear it as an illuminant. A question was asked about metering natural gas. There is a meter in process of construction now (and I give this information for the benefit of the meter men of the Association) which is calculated to work by "injecting the gas at one end and passing it out at the other." I do not know whether or not it is to be protected by letters patent, but the experimenters are working at it now. It will be a machine somewhat on the principle of the steam engine register, with inlet and outlet. If it is ever perfected, I do not think there will be much of a field for it until the output of natural gas has largely decreased from the present volume.

Mr. McElroy—A patent has been applied for.

The President—Did you experiment with natural gas pure and simple as an illuminant?

Mr. Denniston—At our East End works we tried that experiment. Afterwards I found that the very trial I was engaged on had been gone through with once before—and here comes in one advantage of our Associations, in that these reunions afford us knowledge of what has been done in different places, thus preventing repetition of experimental work on the same lines. I tried the experiment of heating the gas, and running it through coiled pipes of large and small sizes. Then I placed an ordinary six or eight-inch gas pipe inside the retort, or after the manner of an inside retort, and closed it up. The clay retorts were destroyed in a short while—of course, pure natural gas was being then operated upon. I next attempted to run naphtha in with it; but it would not work. The gas would invariably smoke. The ceilings in consumers' houses were speedily blackened, because of the naphtha experiment. The poorest results were experienced when we attempted to use the least quantity of coal gas. In fact the only satisfactory light obtained from the natural gas was when the mixture consisted of 600 parts coal gas, 300 parts natural gas, and 100 parts naphtha. I may say this afforded a fairly good light, but it was a hard matter to keep it steady in grade. Mr. Young attempted some experiments with other ingredients, and with different proportions of the same ingredients; but the trials all resulted in failure.

Mr. McMillin—It does not follow because the Pittsburgh gas is not a good illuminant that a like state of the case will be reported from other sections where natural gas is found; and it does not follow because it is odorless at Pittsburgh that it will also be odorless elsewhere. In fact I have in mind a place, not very far from Pittsburgh, either, where the natural gas possesses considerable odor. In the new district at Findlay, Ohio, sulphuretted hydrogen is so prevalent in it that the gas ought to be purified to remove the foulness of smell. I say it ought to be, although they are using it in an unpurified state. I have been much interested in the paper of Mr. Denniston, and in the discussion. I am glad to see the Association is beginning to realize the fact that, in the supply of natural gas, it has a "big elephant" on its hands. A year ago you would hardly have listened to such a discussion as the one brought out here to-day. I doubt not there will be gas wells put down all over the country. Within five years there will be some town in every State of the Union lighted with natural gas. There is no reason why friend Harbison should need to take his supply of natural gas from Pittsburgh; he may get it in New England. The question of the use of natural gas is exciting interest here in Cincinnati. It is barely possible that General Hickenlooper may have a competitor in the natural gas supply, although there are now no natural gas wells of any importance within 200 miles of him. You may be surprised to hear that there are gentlemen in this city who have been in correspondence with me for some time, and who are figuring to bring gas through 200 miles of pipe to Cincinnati. The parties who have the matter under advisement supposed it would take about three million dollars to accomplish the task. No doubt three million dollars will do a great deal; but it appears the cost of that pipe would probably be 2½ times three million dollars. I have made some figures on it. The gentlemen I have referred to said to me that the capitalists investigating this question will not be frightened out if the cost does not exceed ten million dollars, provided that outlay will bring fifty millions feet of gas per day to the city of Cincinnati from the Big Sandy region. It is, however, probable that wells can be put down at a point much closer than Big Sandy. The field that supplies Findlay extends through here. In fact Cincinnati is the very keystone of the arch; but, owing to the erosion of the river, the gas has probably escaped in past ages, and has not been accumulated. But the field of supply extends on down south. Towns in northwest Ohio will have natural gas in abundance after a while. Columbus will have it also, and will not have to go more than thirty miles to get it. I think that gas wells in the lower Silurian, the horizon that Ohio obtains gas from, could be successfully tapped 50 or 100 miles nearer to Cincinnati than is the Big Sandy Well. I was in Pittsburgh a few days ago, and was surprised to see the wonderful change in that dirty city. I inquired of some parties, who had been using gas for some time, as to its cost. The rule there, as generally understood, is for users to pay what their coal had formerly cost them; and the saving is in other directions; therefore they are loth to give you the exact figures, because they have to tell the gas man that their coal cost them one price, when their books might show another figure. Some gentlemen, who were using millions of feet of it, said that it was probably costing four cents per thousand cubic feet. It does not follow, because the experiments of Messrs. McElroy and Denniston failed to make a good illuminating gas of it, that all experiments in the future will also fail. What perfected thing are we using to-day that did not fail the first time it was tried; and the first time this natural gas was tried, by these gentlemen, at least, was only two years ago. The water gas men can sell gas in some towns in competition with coal gas; and we know that it costs them more than four cents per thousand feet to make it; and I do not believe that it is half so good as the natural gas for a diluent of rich or high illuminating gas. I do believe that it is possible to use even this Pittsburgh gas as an illuminant; and that further experiments will

demonstrate how it can be done successfully and economically. Referring to the attempts at measuring the natural gas with a meter; I want to say that I suggested a mode to our State Geologist, Professor Orton, and he made some experiments in regard to it which were quite successful. That method is now being adopted by our geological survey. It is simply using an air meter, placed with the orifice at the open pipe; and if the current is too great for the vanes, and there is danger of twisting them off the axle, I place over the exit pipe a tall box, some two feet square at the top, and five feet high, with the object of allowing the current to slow up by being enlarged. The bottom of the box is just large enough to go over the orifice. In that way we are able to measure it very accurately; and on repeating the experiments we found that we arrived at the same result each time.

On motion of Mr. Harbison, the thanks of the Association were tendered to Mr. Denniston for his paper.

Election of Officers.

Mr. Stedman, Chairman of the Committee on Nomination of Officers, reported that the Committee recommended the election of the following gentlemen as a board of officers for the ensuing year:

For President.—A. C. Wood, Syracuse, N. Y.

For Vice-Presidents.—Malcolm S. Greenough, Boston, Mass.; Thomas Turner, Charleston, S. C.; A. B. Slater, Providence, R. I.

For Secretary and Treasurer.—C. J. R. Humphreys, Lawrence, Mass.

For Finance Committee.—Wm. Cartwright, Oswego, N. Y.; C. H. Nettleton, Birmingham, Conn.; James Somerville, Indianapolis, Ind.

For Executive Committee.—J. P. Harbison, Hartford, Conn.; Emerson McMillin, Columbus, Ohio; Edward Lindsley, Cleveland, Ohio; F. C. Sherman, New Haven, Conn.; J. H. McElroy, Pittsburgh, Pa.; Thomas Curley, Wilmington, Del.

On motion of Capt. White the report was accepted. The Secretary was instructed to cast the ballot of the Association for the nominees. The President appointed Messrs. W. H. White and G. S. Hookey as tellers. Secretary Humphreys cast the ballot as instructed, and the tellers reported a unanimous election of the candidates named by Committee. The President thereupon declared the result, and said: Gentlemen, I have great pleasure in introducing to you, as your next President, Mr. A. C. Wood, of Syracuse. (Applause.)

President-elect Wood—Mr. President and Gentlemen of the Association: I thank you for this renewed expression of your confidence and esteem, and fully realize the importance of the position and distinguished honor you have conferred upon me; and when I remember the gentlemen so eminently distinguished in our profession who have preceded me, I feel it is an honor anyone may feel proud of. I have always taken great interest in the prosperity of our Association, for I thoroughly believe in the great good it has already and is to accomplish. This getting together for consultation on the details of the methods, appliances, and conduct of our business has been productive of great benefit, not only to the companies we represent, but to the general public. There is perhaps no other industry in the country representing so large a capital that has a similar organization. Certainly none devotes its energies in promoting the welfare of the public as does this of ours, for the friendly rivalry that has resulted from our coming together and comparing results obtained from new, or improved old appliances, has resulted in a large reduction in the price of gas and improvement in its quality, and at the same time enables us to make fair returns to our stockholders. It is neither expedient nor desirable at this time that I should make any extended remarks. I will only again thank you for the distinguished honor conferred.

Reporting Progress.

The President—Is the committee which was appointed to name the place for next meeting ready to report?

Capt. White—The committee reports progress.

Proposed Exhibition of Gas Appliances.

Mr. A. C. Wood—Several members of the Association have explained to me they would very much desire that, in connection with the next annual meeting, there might be an exhibit of gas appliances. I move that the committee to name place of meeting be empowered to report a plan of operation for carrying out that object—that is, to arrange for an exhibition of gas appliances at the time and place of next meeting, and in connection with it. Agreed to.

Proposition to Change Time of Annual Meeting.

At this point Mr. J. P. Harbison suggested the advisability of selecting some other month than October for holding the annual sessions, and moved that the matter be referred to Executive Committee for consideration and report, the Committee to be instructed to hand in its conclusions on the subject at some period during the present sessions of the Association. The motion was carried. In the debate on the question Messrs. Harbison, Boardman, and Lindsley favored a change, while Messrs. Somerville and others were opposed to any alteration in the time as provided in Art. XVII. of the Constitution.

The reading of papers was now resumed, and President Vanderpool stated that two communications had been received on the subject of working with limed coal. One of these was contributed by Mr. Jas. Somerville, of Indianapolis, Ind., the other being handed in by the Hon. Member, Mr. R. P. Spice, of London, England. It was agreed that the papers be read in succession, thus paving the way to joint discussion on prominent features of either or both. Mr. Somerville's paper had for its title—

THE RESULT OF A MONTH'S WORKING WITH LIMED COAL.

The author read as follows:

At the last meeting of the Western Gas Association Mr. G. S. Page read a paper on the advantages of adopting the "Cooper Coal Liming Process"—a process with which, no doubt, you are all familiar. I listened with much interest to that paper, and those of you who have had the pleasure of hearing the gentleman speak need not be told by me that his words carry conviction with them—that he has the power, to an eminent degree, of convincing his hearers; and although I had some doubts as to the success of the process, yet before he had finished his essay these doubts had vanished, and he had succeeded in making a convert of me on the spot. Indeed, I began to blame myself for not sooner adopting a process which promised such rich results at so small an outlay.

On my arrival home from the meeting I had two carloads of lime dumped in the coal shed, and proceeded to make ready for the experiment, which consists of thoroughly mixing one ton of coal with 60 pounds of lime slacked with its own weight of water. I began the use of this mixture on the first day of last June, and continued it during the entire month—all the coal carbonized being thus treated. As we are making sulphate of ammonia, and running our works regularly every day, I concluded that by comparing this month with previous and following months a very fair and complete test of the process would be made—the conditions being the same, and lime exclusively used in purification.

The first result which I consider worthy of recording was the transformation that occurred in the coal shed, owing to the slackening of so much lime. It had the appearance of having been newly whitewashed; the coal men were changed to dusty millers; and I can assure you the effect was quite startling to one so long accustomed to the familiar gloom and blackness of that part of the works. The retort house also had quite a changed look. As the charges were drawn a fine white powder would rise and settle on roof and rafter, main and stand-pipe, bringing them out in bold relief. In winter you have observed on the trees and foliage the beautiful effect of hoar frost, from which observation you may get some idea of the influence which the fine white dust exerted upon the appearance of everything in the retort house. But, however pleasant these results were, they were not those which I had in view, and about which I have now to record some disappointment.

The make of sulphate did not increase at the rate which I had anticipated. The heats were not so good, owing, I suppose, to putting so much damp lime in the retorts; and, consequently, the yield fell off somewhat. The amount of fuel was also increased to 10—and even 15—per cent., and the men complained a trifle about the coke clinkering more rapidly in the furnaces. The candle power was not affected in any way. The boxes purified 1,036,000 cubic feet more gas during the month, but the yield of coke was just the same. The coke had a few whitish specks scattered through it; but no one would observe anything unusual about it unless as a result of close examination. The contractor took it all away, and made no sign of disapproval.

To conclude: The make of sulphate was 20 pounds per ton of 2,000 pounds of coal carbonized—one pound more than in the previous and following months. The cost of the lime and labor for mixing was $117.32. The saving in purification was $6.22, and the value of the extra sulphate obtained was $26.22—leaving a deficit of $84.88.

Thus ended the experiment. I should add that last year the yield of sulphate was 21 pounds per ton; but in May of this year I began to use fresh coal from a new mine, and the make of sulphate fell forthwith 1½ to 2 pounds per ton of coal carbonized; showing, I think, that freshly mined coal does not contain so much nitrogen as does coal that has been exposed for some time.

When Mr. Somerville had finished reading, President Vanderpool introduced Mr. R. P. Spice, who remarked: Before presenting the facts contained in the paper that I am about to read, let me say I desire to thank you (I should have done so earlier) for the honor conferred in electing me an honorary member of this Association. I assure you that I esteem it a very high honor. Indeed my surprise is so great that I hardly know what to say to you about it. Permit me, however, to say I thank you most sincerely; and in the few future years which may be left me I shall always regard this Association, and its interests, with great pleasure indeed. (Applause.)

Mr. Spice thereupon delivered the following remarks on the subject of

COOPER'S COAL LIMING PROCESS.

It has been said that there is *nothing new* in using lime with coal in the gas retort, and to a certain extent this is true, just as it may be true, as we read in Ecclesiastes, that "there is no new thing under the sun."

But I am not concerned to show, nor have I ever said, that the mere mixing of lime with coal and distilling the one in the presence of the other, is either new or novel. On the contrary, I unreservedly admit that Mr. Patterson, of Warrington in Lancashire, is entitled to credit for having carbonized coal in that way as far back as about forty years ago.

Probably other men of genius may have had recourse to the same expedient since then, with the sole object of effecting the removal of a portion of the sulphureted hydrogen from coal gas; and in that way helping their insufficient purifiers to complete the work of purification, in a period of difficulty occasioned at the time by having purifiers of too small capacity, and unable to supplement them by larger vessels.

All such attempts, however, were merely temporary expedients to tide over the difficulty which was occasioned by deficiency of purifying space and power, and when this want had been met by the erection of larger purifiers, the expedient having served its purpose, was no longer had recourse to.

In more modern times, when the demand for higher degrees of purity arose, and the removal of sulphur compounds was called for by public opinion in England, extensive and expensive additions to purifying plant were occasioned and adopted. Chemical research led up to the use of the "Sulphide of Calcium" method as recommended by the London Gas Referees, and formulated by Dr. Odling, in 1872, and that has been, till recently, the only known method of keeping the sulphur compounds down within satisfactory limits.

The coal liming process as now known, which was formulated in a laboratory in Victoria street, Westminster, and patented by Mr. Cooper, in 1882, had not previously been promulgated; and when it was made known the invention was treated to the old and familiar luxury of "the cold shoulder," misrepresentation and acrimonious criticism, the usual fruits of the spirit of unbelief, the sad and much too common lot of inventors.

Facts, however, are proverbially stubborn things, and as the facts are *all* in favor of the process at the end of two years' uninterrupted working, all denials of the undoubtedly great commercial and sanitary value of it must prove to be utterly futile and unavailing,

Let whosoever Will,
Attempt to "block the Bill."

The time, indeed, has already come when men who have remained unbiased, while waiting for issues, are beginning to open their eyes to the force of the evidence which has been established in favor of the method; and already my ears have, in this country, been greeted by the common-sense remark, "What can be done at Tunbridge Wells in gas making can be done in America or anywhere else." My reply has been, "Certainly." Nothing, indeed, can be more obviously true; let any man, who may be so minded, assert the contrary, and he will, by so "holding the mirror up to nature," exhibit himself as being one of a lower order of intelligence and mediocre ability; unable to lead, unwilling to follow, and incompetent to do what another man has done and is doing every day, in working a process which, if carried on under the same conditions, *must* produce similar results anywhere and everywhere alike.

The coal used at the Tunbridge Wells Works is from the Newcastle collieries, except about two per cent. of cannel; it contains about 1 per cent. of sulphur, more or less within small limits, just as it may come from one colliery or another. It has been worked continuously since the 31st of October, 1883, now within a few days of the completion of two years, and the purification has been effected as follows:

One purifier, 20 feet square and 5 feet deep, charged, as it happened to be when gas from limed coal was first turned into it, with 30 tons of oxide of iron, has practically done all the purification of about 230 million feet of gas in two years, and has been opened only once in that time—at the end of the first thirteen months' work; when, owing to the deposit of sulphur, the oxide had so greatly increased in bulk as to render the removal of a portion of it imperative, on account of the increased pressure which was so occasioned. It was then found that the 30 tons contained an average of 40 per cent. of sulphur, 30 per cent. being in the upper of the two layers and 50 per cent. in the lower; and, the box having been emptied, only one-half of the quantity, or 15 tons, was returned to it, the other half being placed in the store. Since then this reduced quantity of oxide has been doing the work, with a catch purifier charged with 7½ tons of oxide; and this, as previously, has very little to do. Very recently the gas has been passed through a second catch purifier, by way of precaution.

Formerly, on what may now be called the old system, six of these 20-feet square purifiers were employed to do the work, two being lime boxes and four oxide, and were all required. One of these six vessels would go only ten days in the winter months before being exhausted, and the average number of changes was twenty per annum; whereas, by using limed coal, one purifier only has been opened once in two years, and possibly may continue to do effective work much longer, for we have not yet discovered the limit of its vitality.

Thus the problem of "how to make gas in close vessels," so long desired, has been shown to be not only practicable but economical, and conclusively demonstrated. Words need not be employed to "point the moral or adorn the tale." Purification is no longer a trouble or a nuisance, as hitherto it always has been; and so marked is the improvement in its effects that gas works may be planted in any residential suburb of a town or city, and the manufacture of gas carried on without giving forth any vapors or odors which the most fastidious can designate as being offensive to olfactory organs or health.

The oxide of iron need never more be removed for exposure to the atmosphere for revivification, because, as four-fifths of the impurities contained in crude gas are retained and converted into other elements in the retort, only one-fifth go forward to the purifier; and thus the quantity to be dealt with is so small that one per cent. of common air is sufficient to effect constant revivification of the purifying material *in situ*, without any variation or diminution of vitality, and this will go on until at least 90 per cent. of sulphur has been deposited in the oxide—which will have served the purpose of a carrier or sponge until it becomes surcharged.

Hitherto I have not directed attention to this advantage, nor dealt with it in the way of showing the money saving resulting from it. It is, however, by no means an insignificant item, and one of more importance now than when the market value of sulphur was much higher than at the present time. Formerly—say three years since—oxide of iron was delivered at the Tunbridge Wells Gas Works at $11.25 per ton, and the spent material was taken back at an allowance of $5; the net cost of the supply being therefore $6.25—the spent oxide having been used till it contained about 45 per cent. of sulphur. Now, if 50 tons only had to be thus bought and sold in a year, to maintain the stock in a proper state of efficiency, the net cost of the material would be $312.50.

But at the reduced value to which sulphur has fallen, without any apparent chances of recovery, it is no longer profitable for the oxide dealer to take the spent oxide away at the former or at scarcely any price; hence, but for the coal-liming process, by means of which it is now practicable and convenient to work the oxide until it has taken up 90 per cent. or more of sulphur, the entire cost of it would have to be debited to the purification account; and this would be, for 50 tons per annum, $562.50. This cost, however, thanks to coal-liming, will be avoided entirely, because with 90 per cent. of sulphur it will be worth not merely as *much* but *more* than the original cost of new or fresh oxide.

Of course all such details as these will vary with the ever varying circumstances of particular and individual cases. Proverbial philosophy suggests that every tub should be allowed to stand on its own bottom; but there is not an anti-coal-liming tub standing on its own base anywhere in the gas world which cannot easily be kicked over and rolled away.

Take, for instance, the objective individual who says to me: "Your argument does not apply to my case, for my purification costs me nothing, as I get my new oxide for old without any cost whatever—the new being delivered at my works and the old taken away for the value of it." I say such a man is one of the favored few, and is to be congratulated on his geographical position; but he has to be reminded that the question of the cost of the oxide is not *all* in any one instance in the world, putting aside geography; for unless recourse be had to magic the material has to be *handled*—to be put into the purifiers, taken out and revivified, and put in again, in constantly recurring periods, almost amounting to perpetual motion; an ever-recurring and ceaseless repetition of disagreeabilities, costing money—often much more than the average cost of the raw material. But all this is got rid of by changing the elements in the retorts.

Take, by way of illustration of the saving in cost of labor formerly employed in the purifying department at Tunbridge Wells, when unlimed coal was used (which is a favorable one for objective men, inasmuch as a purifier ran for ten days in the winter months without being changed, which was an unusually easy state of things); twenty of these purifiers being emptied and recharged in the course of a year, the cost of the labor only was $300; but for the *two years'* purification of limed coal gas, the cost of opening the single purifier, which has practically done all the work, has been only $15. The account for labor only in the purifying house, comparing two years' purification of unlimed coal with two years of limed coal, is this:

Two years on the old lines.....	$600 00
Two years on the new.....	15 00
Saving.....	$585 00

But, it will be said, this is not a net saving, inasmuch as there will be a set-off in the cost of labor employed in liming the coal. And that is so; but the cost of effecting this is trifling in comparison with the expense attendant on working the purifying plant with unlimed coal.

I have not at hand, and therefore cannot give, the figures representing the small additional cost of labor in the coal store, where the lime is slaked and added to the coal; but I can say that one man was employed as coal wheeler before, and that one does the work now, with a very little occasional assistance. The lime is slaked by its own weight of water, supplied conveniently under pressure through a flexible tube fitted with a fine spreading nozzle, and then mixed with such coal as contains the ordinary percentage of sulphur—the proportion for such coal being 2½ per cent. of lime plus the water; and as nothing is lost, all matter being indestructible, the whole of the lime becomes incorporated with the coke, and the water goes forward as ammoniacal liquor.

The coke is improved by the addition of the lime and its value increased for many purposes; the noxious products evolved by its combustion being reduced, and its calorific power increased; and as regards the cost of thus using lime in carbonization, all depends upon relative circumstances. If the lime costs less per ton than the selling value of the coke, and all the coke which is made is sold by weight, as all coke should be, the lime will have cost something less than nothing; and this is not an imaginary case, for I have met with just such an one in this country.

In the case I now refer to, which is situated in one of the Western States, the quantity of coal carbonized is 6,000 tons per annum, and all the coke produced is sold, none being used on the works; the fuel used for heating the retorts being a cheap kind of coal, and the gas is purified by lime only.

All the lime used in the purifiers is entirely wasted, and costs something to cart it away; a purifier has to be emptied and recharged with fresh lime every other day in the summer months, and every day in winter. But by liming the coal, which contains 5 per cent. of sulphur, and using oxide of iron in the purifiers, the labor involved in constant changes will be saved, and the lime will cost less than nothing, because all will be sold with the coke at a higher price than it cost.

Under these conditions the increase of profit will be, by the returns from sale of the lime, which is now wasted..... $1,575.00

And the increase in quantity and value of ammonia, at present price..... 600.00

Total..... $2,175.00

In the spring of this year I met with a more extreme case of the kind at a gas works on an island in the Mediterranean, where coke is sold at an average exceeding $5.00 a ton, and the lime cost only $1.33; therefore, in that case, every ton of lime, after having been used in the retorts, would, when sold, realize a profit of $3.67.

I do not hold these examples forth as common cases, but, although exceptional, they are strictly true. I do not give the names of the places because I do not consider it right or proper to publish any information concerning the business affairs of my clients unless I am specifically authorized to use the information obtained.

Any engineer or manager of a gas work can determine what the result may be in his own case, as to profit, by taking into account the selling value of the coke, the cost of the lime, and the quantity of the coke left for sale after using what may be required for use on the works; sometimes the coke is all sold, as in the case I have quoted, but in no case should the quantity used exceed 30 per cent., and 70 per cent. should be for sale.

The next item I will refer to is the cost of wear and tear, which, instead of being increased, as the disaffected ones anticipated, through the alleged rapid destruction of furnaces, etc., has proved to be less than before, the exact difference of cost between the year 1883, when unlimed coal was worked, and 1884, when the coal was all limed, amounted to 8 cents per ton of coal carbonized in favor of the limed coal process.

I have now only to add to the other economies which I have dealt with the very important one of the production of ammonia. This is increased to the extent of 30 per cent., and the truth of this has been confirmed by the accounts of the Tunbridge Wells Company. All the liquor is worked up into sulphate, and in the last half year, ending 30th June, the quantity made was 70 tons 12 cwt., and realized the sum of $2,415.00 from the carbonization of 5,833 tons of coal. Comment on this is not needed, the figures will speak for themselves.

As regards the character of the gas thus produced, it contains not more than 250 grains of sulphureted hydrogen at the inlet to the purifier, instead of the ordinary quantity contained in crude gas when made in the ordinary way, which ranges from 500 to 1,200 grains, and 15 grains of sulphuret of carbon, instead of from 30 to 60 grains; less than 1 per cent. by volume of carbonic acid, and 4 per cent. of carbonic oxide, instead of the usual 6 per cent. contained in ordinary coal gas, and the 28 per cent. in water gas, as that gas is made in New York and Brooklyn; so that unlimed coal gas contains 50 per cent. more CO than that made from limed coal, and limed coal has 700 per cent. less of that noxious element than New York and Brooklyn water gas; and as to sulphur compounds, the average has been found to be about 12 grains in 100 feet.

The proved advantages which I claim for the process are: Diminished cost of gas; the saving being more or less according to the varying circumstances of each particular case, the amount depending, of course, on the cost of materials and value of products.

The ease and certainty of effecting and maintaining quality and purity within prescribed limits.

And the non-pollution of the atmosphere by offensive odors in the vicinity of the works.

[To be continued.]

[A Paper read before the Society of Gas Lighting.]

Three-Hour Charges.

By Mr. A. B. Slater.

The question, "What are the best conditions to be maintained in the distillation of coal for the manufacture of illuminating gas?" is one upon which a variety of opinions still exist; and although we now produce a much larger quantity of gas from the same given plant than formerly, yet only a comparatively slight substantial improvement has been made in the manner of distilling the coal, since a large portion of the illuminating value of the coal is still wasted. Some of our members, without doubt, can remember when it was the ambition of the foreman of the retort house to produce and keep up a "cherry-red" heat in the iron retorts; and an average yield of 3½ feet of gas per pound of coal was not uncommon, while 4 feet per pound was considered extra good work. The yield of tar was much larger then than now; and the lighter products distilled from the tar were so great that while the tar distiller paid $2.50 per barrel for that residual, his net profits were then in excess of those now obtained from the products extracted out of the tar made at some gas works, and for which he pays at the rate of 50 cents per barrel. Then small retorts were used; low heats were the rule; the time occupied in distilling the charges often ran from five to six hours; large quantities of clinker formed in the furnaces, necessitating the drawing of the grate bars, dropping the whole contents of the furnace, and cutting or breaking out the mass of clinker which adhered to the furnace walls, thus greatly cooling off the retorts even to the extent of cracking, and causing them to leak badly when the next charge was introduced. The heat, as they thought, would carbonize a certain quantity of coal in four, five, or six hours, as the case might be—the last hour of time being necessary to accumulate heat sufficient to take the next charge; and so, with low heats and the loss of retort duty, the results could be but moderate. Later, when 4½ feet of sixteen candle gas, without aid of enricher, was reported, the statement was derided as being an impossibility, the denial usually being supplemented by the remark, "It's no use; you can't get more out of the coal than there is in it." Now still greater results are common; and even a product of 5 feet of seventeen-candle gas, without enricher, has been made.

During the last eight or ten years close attention has been given to the application of the principles upon which more perfect combustion, as applied to the heating of retorts, depends; and this study has resulted in the development of various forms of generator and regenerator furnaces, which already show marked improvement over the old heating methods pursued. But why can better results be obtained with regenerator furnaces than those secured under the old style of furnace systems? Simply because in the new practice the combustion is more perfect; the heat is better utilized; the necessity for dropping the fires to remove clinker is overcome; and better and more uniform heats are constantly maintained. In short, the best form or kind of furnace is the one which will secure the most perfect combustion, and best utilize the heat produced—this, too, in the bench itself rather than in the furnace proper, thus securing the minimum of wear and tear in the furnace, as well as affording great saving in the consumption of fuel.

Now, why should the charge remain in the retort five or six hours, or even four hours, provided the necessary heat can be developed to properly distill the coal in three hours? We all know very well that when we run four-hour charges the gas which comes off during the last hour is both small in quantity and poor in quality; and the gas chemist tells us that much the larger portion of the impurities is carried over during the last part of the time which the charge is run. In fact, oftentimes in an experimental works we find the meter will stop entirely (sometimes before the end of the last hour) when a four-hour charge is run. A fair illustration is afforded from an experiment made by Mr. C. D. Lamson, of the Boston (Mass.) Gas Works, and reported to the New England Association of Gas Engineers at their annual meeting in February, 1876. With the ordinary furnace, in an experimental works, during the first three hours he produced 11,340 cubic feet of 14.37 candle gas = 4.72 cubic feet, or 67.82 candle feet, per pound of coal. During the fourth hour he produced 1,000 cubic feet of 2.57 candle gas = .42 of a cubic foot, or 1.08 candle feet, per pound of coal; thus showing that, of the total quantity obtained during four hours, the quantity produced during the last hour was only a fraction over 8 per cent. in quantity, and less than 1.6 per cent. in illuminating value as stated in candle feet. At the end of

the fourth hour he had carbonized 200 pounds of coal per retort, with a yield of 68.92 candle feet per pound of coal; and at that rate, for 24 hours, his yield in candle feet per retort would have been 82.704. At the end of the third hour his yield in candle feet was 67.82 per pound of coal; but with three-hour charges for 24 hours his product, upon the yield which he shows for the three hours, would be 108.512 candle feet per retort, or over 31 per cent. more.

It may be said it would be difficult to carbonize 200 pounds of coal every three hours with the old style of furnace. That is quite true; but still it is being done with regenerator furnaces every day, and over 40 to 50 per cent. more coal per charge is worked off every three hours. The above figures are made on the basis of 4.72 cubic feet per pound of coal for three-hour charges; but, as a matter of fact, instead of 4.72 cubic feet per pound of coal, 5 feet and over is obtained, which makes the difference in favor of three-hour charges still greater.

After stating these facts I will leave the question of gain secured during the fourth hour to be ciphered out by the advocates of four-hour charges.

Another illustration may serve to bring out some of the points involved. Suppose it were possible to introduce the coal and remove the coke from the retorts continuously, or without interruption, and also to maintain the required degree of heat in the retorts; then the gas would be uniform both in quantity and quality. Now take the other extreme. With a given heat in the retort, introduce all the coal the retort will hold; of course the heat is at once reduced, and the conditions are constantly changing from the beginning of the first to the end of the last hour; and just in proportion as the conditions change from the approximately perfect ones in the first case, just in that proportion will the results be different, with consequent development of loss in the same ratio. The richer gas comes over during the first two hours. During the third hour the gas is less both in quantity and quality; and when four-hour charges are run the last hour will show the gas still poorer in both these respects, and thus deteriorate the whole volume produced during the previous three hours. One alleged objection to three-hour charges has been raised in that the retort is opened twice more in 24 hours than when four-hour charges prevail—consequently more air is taken into the vessel. A moment's reflection will show that the quantity of air remaining in the retort when the lid is put on is, in any case, infinitesimal in quantity. In my judgment one of the principal objections to three-hour charges has been the inability to maintain the proper degree of heat, as is the case with the old-style furnaces. Another objection is raised by the stokers, who naturally prefer to charge at longer intervals, because they have more time to "lay off and smoke." To the manager who often depends more on the whims and preferences of his men than upon his own judgment and knowledge of the fact, this objection is made effective; and so it has always been that when any change from the routine of old established customs and habits is made, especially in the retort house, the men are almost sure to show dislike and disapproval of it; and representations are made to the manager or superintendent which generally settles the matter in favor of the views held by the "hands."

Our attention was called to the results obtained from light and heavy charges of coal (at the February meeting of the New England Association of Gas Engineers, in 1876,) by Dr. Kidder, of Boston, Mass., when he said, "A fact of common experience in gas making is that richer gas is obtained from light than heavy charges of coal in the retorts, if drawn at the proper time. This does not depress the temperature nearly so much; allows of greater freedom for escaping vapors, with less exposure to incandescent coke; and affords a larger generating surface in the retort, which, with heavy charges, is quite too limited to be effective. Good standard coal or oil gas in contact with incandescent coke will so analyze the hydrocarbon vapors as to wholly destroy the illuminating power of the gas."

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Nov. 10, 1885.

Death of Mr. F. W. Hartley—Disposal of the London Sewage—The Sulphate Market, and Direct Trade between Producer and Consumer.

Mr. F. W. Hartley, a gentleman well known in English gas circles as manager of the firm of Messrs. A. Wright & Co., gas meter and apparatus manufacturers, of Westminster, and more widely by reason of his numerous books, pamphlets, and papers, relative to photometry, and the general experimental portion of gas engineering, died suddenly on the 17th ult. I am sure that his name is sufficiently familiar to the readers of the AMERICAN GAS LIGHT JOURNAL to enable them to fully appreciate the fact that in the sudden and premature (for he was only 56 years of age) removal of this talented and conscientious scientist from the scene of his labors, the gas world has sustained an irreparable loss. We always regret the passing away of a useful life, even when it has reached the limits prescribed by the grand old Hebrew psalmist; yet, under such circumstances, our sorrow is tempered by the consideration that such must be, according to the natural order of earthly things; but in the case of our friend, who has left us when in the zenith of activity, usefulness and manhood, our pain at his untimely removal is increased by the thought that he might have been spared to us for another twenty years or so, to assist us by his skill and ability, no less than to maintain our admiration for his sterling qualities of character, and (to the numerous circle who enjoyed that privilege) our great regard and esteem in social communication with him as a man and a brother. Those of your readers who have not been personally acquainted with the late Mr. Hartley may perhaps be inclined to regard this language as hyperbolical, and put on for the sake of effect; but I may confidently refer to the articles and numerous letters that have appeared in our special technical journals, as a proof that the above is in no way an exaggerated representation of the general feeling amongst English gas engineers, in respect to this greatly regretted event.

The limits of space at my disposal forbid my attempting anything like an obituary notice, such as those which have already appeared in the *Journal of Gas Lighting*, and other periodicals, nor is it necessary for me to do so, much as I should have liked to have enlarged upon this topic. But there is one point to which I should like to be allowed to refer. The late Mr. Hartley was not a man who enjoyed the favors of fortune in a pecuniary sense. He was, in every sense of the word, a self-made man, who rose to the position he attained by dint of untiring industry and integrity. At an early age he attracted the notice of the late Alexander Wright, and entered his service, gradually working his way up until he attained the position of confidential manager, and since the death of his early friend and employer, some 26 years since, he has conducted the affairs of the firm to the entire satisfaction of the proprietors, but with no advantage to himself and those dependent upon his exertions (if I am rightly informed) beyond the salary paid for his services. He married early in life, and has reared a large family of five daughters and three sons. Under these circumstances it is easy to understand that he has not had the opportunity of realizing a competency for his family—indeed so strictly upright and conscientious was he in all his dealings that probably he has refused many opportunities of realizing pecuniary profit, which less scrupulous men would not have hesitated to embrace. So, like many other worthy men, who have been removed from this world before they have completed their regular course, he has left a very inadequate provision for his family. The leading gas engineers in this country have agreed, with praiseworthy unanimity, that the present circumstance affords a suitable opportunity for recognizing his services to the gas industry, in a manner that would not be feasible under any other—by raising a substantial fund for the benefit of his children. Mr. Hartley was amiable and generous to a fault, and a personal friend of many years standing testifies that he was never known to speak ill of any, even of those who opposed or sought to rival him in any way. So the response to this appeal will be liberal, and many will join the writer in feeling that in subscribing their mite to the fund they are only offering an inadequate return for benefits received, through the medium of the published essays and papers from the facile and practical pen that is now at rest for ever. I believe that some amongst this class will be residents on the other side of the Atlantic.

The disposal of the London sewage is a matter that has considerably exercised the minds of the engineers connected with the Metropolitan Board of Works for many years. When we consider the freedom of this vast metropolis, with its population of some five millions, from the scourging epidemics so frequent in some other and less populous cities, which it has now enjoyed for a long time, it is evident that great credit is due to all concerned for their energy and skill, without which this great work could not be carried out in a manner devoid of nuisance or injury to the public health. As it is, London is looked upon as amongst the healthiest localities in the country. The system hitherto followed is simply to take the sewage away. No attempt has been made in the way of utilizing it, either by irrigation or by chemical treatment, although experiments to that end, sometimes on a considerable scale, have from time to time been under the attention of the authorities. Hitherto the practice has been to convey it to Crossness, some 20 miles down the bank of the river Thames, and there discharge it, after applying the best known methods of deodorization and disinfection, into the river. Large storage reservoirs have been constructed capable of containing a day's production—35,000,000 gallons—and other means adopted so that the discharge can be made only when such tidal conditions obtain as will secure its being washed out to sea. This carrying out to sea, however, is not effective in practice, and a large quantity of more or less offensive solid matter remains in the river, accumulating to such an extent at bends and other localities which afford a convenient resting place for it, as to render continual dredging necessary to avoid the hindrance of navigation. It is now practically proved that the river is not capable of discharging the double office of an outlet for the London sewage and a way for navigation. Several schemes have been proposed as an improvement on the existing system. One o

these, called the Canvey Island scheme, has attracted a great deal of attention, and received support in high quarters. Its main features are the purchase of an island of that name, situated at the mouth of the river, and to carry the chemically deodorized sludge to that piece of land, where it is to be utilized, if practicable, for irrigation purposes on a large scale. My object in referring to this matter is to notice an ingenious and apparently feasible suggestion advanced by Mr. J. Orwell Phillips, the Secretary and General Manager to the Gas Light and Coke Company. The works of this company are situated near to the present place of outfall—in fact the main conduit to that spot passes close by the premises of the company. They possess a fleet of vessels engaged in supplying the enormous quantity of coal required by them—no less than some 1¼ million tons per annum—also ample landing space for dealing with this enormous bulk of material. Mr. Phillips suggests that but little difficulty or expense would be necessary to make arrangements for preparing the sludge on land adjacent to the gas works, and conveying it to the vessels, which at present make their return journey to the north of England without cargo, and the vessels could part with their unattractive passenger by throwing it out to sea at any desired part of their track. The suggestion is remarkable for ingenuity and originality. Certainly, if the sewage must be thrown away, the Gas Light and Coke Coke Company, possessing these special advantages, are in a position to throw it away so effectually that it will not emulate the proverbial bad penny in "coming back again," as at present it seems to do, on much lower terms than any other contracting body could possibly be in a position to offer.

The proposed sulphate of ammonia makers association, to which I referred in the concluding paragraph of last month's letter, is making satisfactory progress, and a preliminary meeting is to be held in the course of a few days. The necessity for such an association is perhaps rendered more apparent by the fact that certain dealers in sulphate, in their circular to their customers, have gone out of their way to endeavor to throw cold water upon the movement. A certain Mr. John Angus, of 47 Lime street, London, E. C., evidently belongs to this class, for in the course of a letter published in the correspondence columns of the *Journal of Gas Lighting*, he takes the opportunity to remark, "that it is beyond the power of an association to do any permanent good." All this serves to show the importance of developing a direct trade—a direct communication with the consumer—and this remark applies to other things beside sulphate. Take coke, for example; the gas engineers who realize the best returns for this residual will be found on examination to be those who look after a good retail trade. It is very nice to settle at one transaction the sale of perhaps several hundred tons of material, and to know that the check in settlement of the same will be dropped into the official letter box at the appointed date with no further trouble. So long as the producer retains full command of the market this will do very well. But if the material is bought to sell again, and the process above indicated is allowed to extend to a considerable proportion of the total sales, the dealer begins to encroach upon the position which the producer should jealously retain. I know one instance of a gas manager who found difficulty in getting rid of his coke, and accumulated a large stock on hand. Instead of casting about in the direction of developing a direct trade, he sold a quantity by contract to a dealer at a low rate; and this dealer easily accomplished the work which the gas people had not sufficient push or energy to do—the development of a retail trade in the neighborhood. So all went on well for a few years. The gas manager's coke yard was always empty, and the coke was promptly paid for. But after a time a "change came o'er the spirit of the dream." The plausible dealer, having obtained a command of the market, talked about lower rates, together with unpleasant allusions to bringing coke from a distance, and introducing anthracite coal and other fuels as an improvement on coke for certain purposes. So the gas engineer was brought around to low terms, and his last state was worse than the first. If we substitute nitrate of soda for anthracite in this instructive illustration from hard facts, I think it will furnish a fair representation of the state of affairs in the sulphate market during the last few years. The dealers have got the command of the market, and when such is the case, whether with sulphate or any other commodity, the producers must look out for hard times.

After the first meeting of the proposed association I shall be in a better position to deal with the remedy for such a state of affairs. At present it will be sufficient to point out how to avoid getting into it. This can readily be done by looking sharply after the direct trade. If stocks increase, it is better to accept an all-round reduction in price, than to sell off a portion at a largely reduced rate. Also the seductive offers of large buyers who are not *bona fide* consumers must be declined. Of course, it is easy to be wise after the event, but I certainly think that, as in many other branches, there is too much tendency amongst gas engineers to leave the market for residual products to the tender mercies of dealers.

No Gas as Yet in the Ironton (O.) Well.—The Belfont Mills well is at a depth of 2,050 feet without any sign of gas. They will go deeper.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

No Charge for Gas Supplied to the Engine Houses.—It is said that the Philadelphia Company (dispensers of natural gas) furnishes all the ward fire engine houses of Pittsburgh with gas without making any charge for same.

Electric Light for the Streets of Denver, Colorado.—The city's annual contract with the Denver Gas Light Company for street lighting in that locality expired with first of October, and the municipal authorities, up to our last advices, appear to have about determined that electricity will be employed as a substitute for gas in street illumination. Proposals were asked for, and those submitted developed the following state of affairs: The Denver Gas Company proposed to light all gas lamps at present in use (450) for the sum of $35 each per annum—on a three-year contract basis—and to charge $35 per year for each additional lamp erected that might be ordered put up in new territory. The Company further agreed, if the city would contract for the erection of 100 new lamps (or a total of 550), to light same at an annual charge of $30 per post. A special proposition was also put in, and to this effect: Should the city desire to more effectually illuminate certain business quarters, the Gas Company would agree to put up high-power Siemens burners, each to give a light equal to 500 candles, to burn every night in the year until 12 o'clock, at a charge of $144 each per annum—the city, however, to agree to the erection of not less than 40 such burners. The special proposition was further qualified by an agreement of the Company to light (after midnight) the ordinary lamps in the districts occupied by the Siemens burners at a charge of $20 per annum each, such charge to be deducted from the annual amount received by the Company for the general lighting of the city. Two propositions were received from the Colorado Electric Company, and were as follows: To supply any number of arc lights that might be ordered—on a three-year contract, at $150 each per annum; five-year contract, $130 each; ten-year contract, $110 each. [It might be here said that all bids were adjusted to an agreed moon table.] The same Company proposed, if incandescent lights were preferred, to supply the 450 posts now in use with burners rated to develop 20 candle power, on basis of three-year contract, at $28 each per annum; five-year contract, at $25; ten-year contract, at $23. All the above propositions were referred to the consideration of a joint committee of City Council, and it took them just three days to decide what course to recommend. They reported in favor of the incandescent scheme, and advised that an additional 66 lamps be erected in the business part of the city, thus bringing the total up to 516. The report was accepted by Council, and a resolution was passed which directed the City Attorney to draw up a contract authorizing the authorities to enter into a three-year contract with the Colorado Electric Lighting Company at the figures named. This does not settle the matter, as the action of the Council requires to be ratified by the Board of Supervisors before final disposition of the affair can be reached. We would ask Brother Fay to kindly inform us of the action taken by the Supervisors in the premises. Before dismissing the subject we cannot forbear making inquiry as to why the Aldermen (if they were so well convinced that incandescence lighting was of such superior nature) did not recommend an acceptance of the "ten-year proposal." Perhaps all that was understood by the electric lighting folks when they made their bids.

Milwaukee (Wis.) Thinks Gas is Good Enough.—Some time ago a resolution was passed in the Milwaukee City Council authorizing the lighting of the streets of that place by electricity. Subsequently the Mayor vetoed the resolution, and afterward the Council refused to override the veto. In his message on the subject the Mayor placed great stress on the necessity of placing underground all wires employed in the transmission of electric lighting currents.

A Gas Company Changes Hands.—According to the Utica *Herald* a majority of the stock in the Little Falls (N. Y.) Gas Light Company has been purchased by I. S. Elkins, and that reorganization of the corporation has been perfected. It is now reported Mr. Elkins wants to sell out.

Wooden Gas Mains Still in Favor at Green Bay, Wis.—Supt. J. G. Miller, of the Green Bay Gas Works, reports that extensive additions to the company's mains have been made during the past summer. Much work was also done in the direction of placing the pipe already down at greater depth, or so as to be out of reach of the severe frosts experienced in that region. Square (external) wooden mains, painted with coal tar, are employed. When the plant was first erected (over 16 years ago) ordinary round logs (with roughly bored centers), from which even the bark had not been peeled, were put down; and Mr. Miller avers that, when some of these old conduits were displaced during the summer's main-laying operations, the wood was perfectly sound, although, he admits, "the bark dropped off."

The Natural Gas Industry at Findlay, Ohio.—It is said that the seven natural gas wells now in active flow at Findlay supply a greater quan-

tity of gas than could by any sort of possibility be used in the manufacturing establishments now centered there. The *Petroleum Age* is responsible for the assertion that during the fair at that place the streets and road leading to the fair grounds were lit by natural gas. A line of natural gas jets, making a flame of fire several inches thick, extended the whole length of the route, and made the way as light as day. Gas for the lighting and heating purposes of a large residence is supplied for $40 a year. No meters are used, but consumers burn all that is wanted. Nearly all the factories are using gas in place of coal, and Findlay is booming.

Another "Experimental Station."—A wideawake correspondent at Tiffin, Ohio, says he noted, among our "Items of Interest" of last issue, the reference to electric lighting troubles at Brockton, Mass., and goes on to remark, "If that is an experimental station, what would be said of the one in operation at Tiffin? Such a trifling circumstance as the shutting down (at night) by our local Edison company is not regarded of great importance, since the electric company's patrons keep on hand a supply of oil lamps—and so enjoy a really unusual sort of illumination when the electric agent 'goes out.' I have heard the Tiffin station spoken of as being an experimental one, but did not before understand the full meaning of the expression. I might say right here that (as a class of men claiming to be 'scientists,' 'progressive engineers,' etc.) the builders of Edison incandescent plants do not seem to gain anything by experience. The same unsatisfactory performances are witnessed in other places as well as here; and as surely as the lights supplied from the 'experimental stations' of Brockton, Mass., and Tiffin, Ohio, 'go out,' so also will the 'users of the lamps' be treated to like benefits at Lawrence and New Bedford. Perhaps Mr. Price could post our Tiffin electricians up to the point of 'working the game' of 'beyond the pale of possibility,' etc."

Smashing the Glass in the Lamp Post Lanterns.—On date of Nov. 20th Gen. Chas. Roome, President of the Consolidated Gas Company, of New York city, made complaint to Supt. Murray that within a few nights the glass of 133 gas lamps, in the district bounded by Horatio and West 18th streets, Ninth avenue and North River, had been broken by mischievous schoolboys. The superintendent issued the necessary instructions for the detection of the youthful offenders. This item of broken glass figures to a good round sum in the course of a twelvemonth.

Progress Made on the Works of the Bay State Gas Company, of Boston, Mass.—The Beacon Construction Company (Limited), of 425 Chestnut street, Phila., Pa., is the contractor for building the works of the Bay State Gas Company, and work on the contract is being vigorously prosecuted. Up to November 19th the following had been accomplished: In the first place, the works are being erected in the district known as "Calf Pasture," where a plot of 60 acres of land has been secured. The brickwork of two tanks (each 154 feet by 30 feet) has been completed, and the bottom to one has been finished; the central core of remaining one was being removed. Some five to six miles of mains are already down; and the filling in and wharfing of the property is being pushed ahead. The iron work is to be got out during the winter in readiness for putting up (together with the buildings) early next spring. The promoters of the company declare they will be ready to supply water gas to their consumers by Sept. 1st, 1886; and assert that the gas will contain less than 10 per cent. of carbonic oxide. But no matter what be the percentage of that noxious ingredient sent out in their gas this fact remains—the city of Boston required the services of the Bay State Gas Company in no way, shape or manner. Its residents were pretty safe to have cheap and good gas supplied them for years to come; but such assurance is now imperilled. After the war will come the period when the expense of same must be met. It may be of interest to know that the managers of the "Beacon Construction Company" are the following: J. Edward Addicks, Chairman; W. H. Miller, Secretary; R. C. H. Brock, Treasurer,; and B. F. Sherman, General Manager.

Death of Mrs. Ellis Lever.—We regret to announce the death of Mrs. Ellis Lever, which sad event occurred at the homestead—Culcheth Hall, Bowdon, England—on date of Thursday, Oct. 29. Mrs. Lever, in company with her husband (a most estimable gentleman he is) made an extended trip through America some three years ago; and those of the fraternity who then enjoyed the pleasure of meeting in a social way with the voyagers will now deplore the fact that death has removed her from the home circle which she so enlivened and adorned.

The Lights "Go Out" at Dundas, Canada.—At 8 P. M. of Sunday, Nov. 1, the gas consuming portion of the inhabitants of Dundas found themselves without light. The hour of the occurrence was a most unfortunate one, as services in the several churches were just beginning; but clergymen and congregations accepted the situation in a "proper spirit," one of the ministers putting it thus: "Sing the doxology, and get out as best you may." The trouble was occasioned by a break in an 8-inch main, and Manager Thomas reports that about 20,000 cubic feet of gas escaped—a serious defection in the supply from a small plant. By the next evening everything was in smooth working order.

What Prof. Douglas has been Doing at Ann Arbor, Mich.—Prof. S. H. Douglas, the active and energetic gentleman in charge of the affairs of the Ann Arbor Gas Light Company, has been making the summer months "count," and a "tallying up" shows in the nature of a great gain in efficiency regarding plant and apparatus. The improvements include, first, the placing of an automatic governor; second, the introduction of a Roots exhauster; third, the addition of a Pelouze & Audouin condenser; and fourth, the construction of an improved set of regenerator furnaces. An examination of the items given will go to show that the Ann Arbor plant has been almost entirely reconstructed; and in view of the superior manufacturing facilities thus afforded, the Professor determined that he could make a reduction in selling rates, the same to go into effect from date of Nov. 1st. The amended schedule is as follows:

A monthly consumption of under 2,000 cu. ft.....	$3.00	per M.
" " of over 2,000 and less than 5,000.	2.50	"
" " of 5,000 cu. ft. and over.....	2.20	"

On all classes of consumption, in consideration of settlement of accounts on or before tenth day of month, a discount of 10 per cent. is allowed. The Professor is just as enthusiastic as ever on the subject of ferric oxide as an agent for gas purification; and well he may be, for the results obtained by him with it at the Ann Arbor plant are excellent in every respect.

Ordered to Abate a Nuisance.—Complaints having been made to the Poughkeepsie (N. Y.) Board of Health that a most offensive odor was constantly arising from the water in the vicinity of the foot of Pine street, that city, a special committee of the Board was deputed to examine into cause of odors and to report measures for abatement of same. After thorough examination it was determined that the Citizens Gas Company (an outlet from that works discharged into the river at the point complained of) was the offender, and also that the odor developed was detrimental to the health of the people. Expert testimony was secured, and the Health Department of this city was interviewed on the subject, the opinions of the gentlemen consulted all concurring in the verdict rendered. On Nov. 20 the special committee reported its conclusions back to the Health Board, and immediately thereafter the Board adopted the following:

"*Resolved*, That the Citizens Gas Company, of Poughkeepsie, be notified to abate and remove the said nuisance, within 30 days from the service of a notice upon them, under a penalty of $200 for non-compliance with the said order, and an additional penalty of $20 for each day's neglect beyond the specified time."

Chartering another Gas Company for Brooklyn, N. Y.—On date of Nov. 19th papers were filed with the Secretary of State incorporating the "Peoples' and Consumers' Gas Company, of Brooklyn." The incorporators named are Messrs. Lindley Murray, Geo. A. Hoag, Albert C. Gunnison, Robert H. Rountree, David P. Templeton, Alexander Cameron, Thomas Wilde, John Rooney, and Alfred N. Ladd. The capital stock is fixed at $3,000,000, par value of shares $10. Here are some of their "pledges;" and we regret that our space is so limited as to preclude present comment on them—

"That the association shall contract to supply gas of first quality to all consumers at $1 per thousand feet.

"That all subscribers to this stock and all consumers shall bind themselves to take gas from this association only so long as it shall be furnished at the above stipulated price, and of satisfactory quality, and that no inducement of a lower price offered by any other company shall be allowed to interfere with this arrangement. Consumers will at once see the necessity for this stipulation, if they wish permanency in the price of gas. It will, of course, be the immediate attempt of the combination (which charges $2.00 for a poor quality of gas) to get this association out of the way by underselling it, and, its ruin being accomplished, they will at once put up their price again. If consumers are satisfied that $1 per thousand, together with the returns offered by this association, constitute a fair and reasonable charge, they must remember that the only way by which it can be permanently maintained is by a firm support of the association.

"Dividends not exceeding 15 per cent. per annum shall be paid on the capital stock out of the profits, over and above the cost of manufacture and expenses of conducting the business."

The Growing List.—"Balt., Md., Nov. 23.—Shortly before midnight on Saturday, C. A. Thorpe, of Perryville, and J. White, of Frenchtown, went to bed in a public house on Gay street. At 11 o'clock to-day the chambermaid found the door locked. An entrance was effected, and both men were found dead in bed, and gas was still escaping from the burner. It is supposed they blew out the light."—N. Y. *World*, Nov. 24.

The Market for Gas Securities.

The dealings in Consolidated gas during fortnight have been marked by lower prices; but towards the close values stiffened considerably, and at time of writing (2 P.M. Nov. 30) bid and asking figures are 103–103¼, respectively. The directors have declared a dividend of 3½ per cent., payable on and after Dec. 15th. In the interim "par and one-half" was the figure at which one or two small transactions took place, but the bulk of trading occurred in the region of 2½ to 3. The Senate "Smelling Committe" has so far failed to develop much of interest, save to expose the true nature of reformer Sherwood's opposition. The higher priced Brooklyn shares are so sensitive that notice of the formation of a projected opposition company caused a slight decline in value. Fulton Municipal, after selling up to 161, receded to 159; and Williamsburgh is down to 159–160. These shares are at decidedly "fancy" prices, and it looks as though holders might "make a turn" on the short side. On the other hand, Brooklyn Metropolitan shows an advance of about two points. Mr. Elkins is reported as having purchased control in Little Falls (N. Y.) Gas Company, and is now anxiously seeking for some party willing to "take the bargain off his hands." The death of Col. Peter Donahue, who was largely interested in the finances of the San Francisco (Cal.) Gas Light Company, occurred on Thursday, Nov. 26th.

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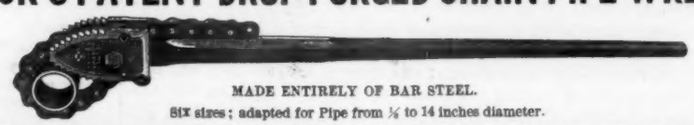

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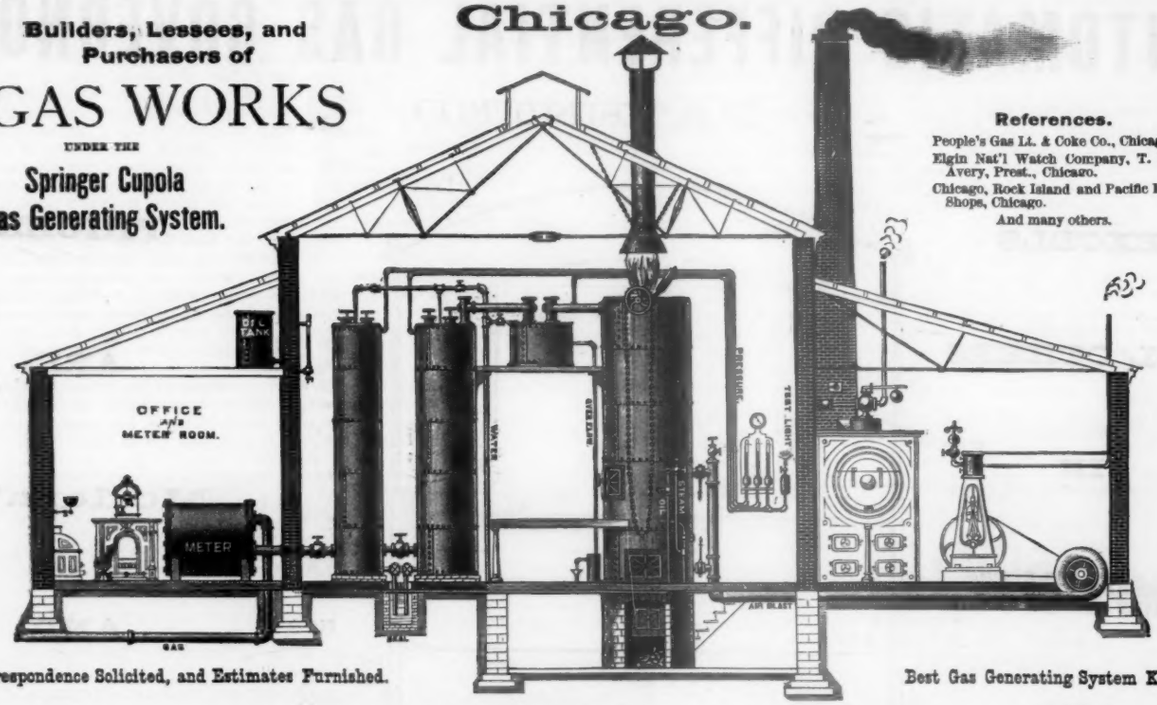

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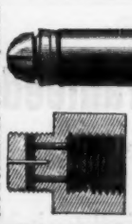

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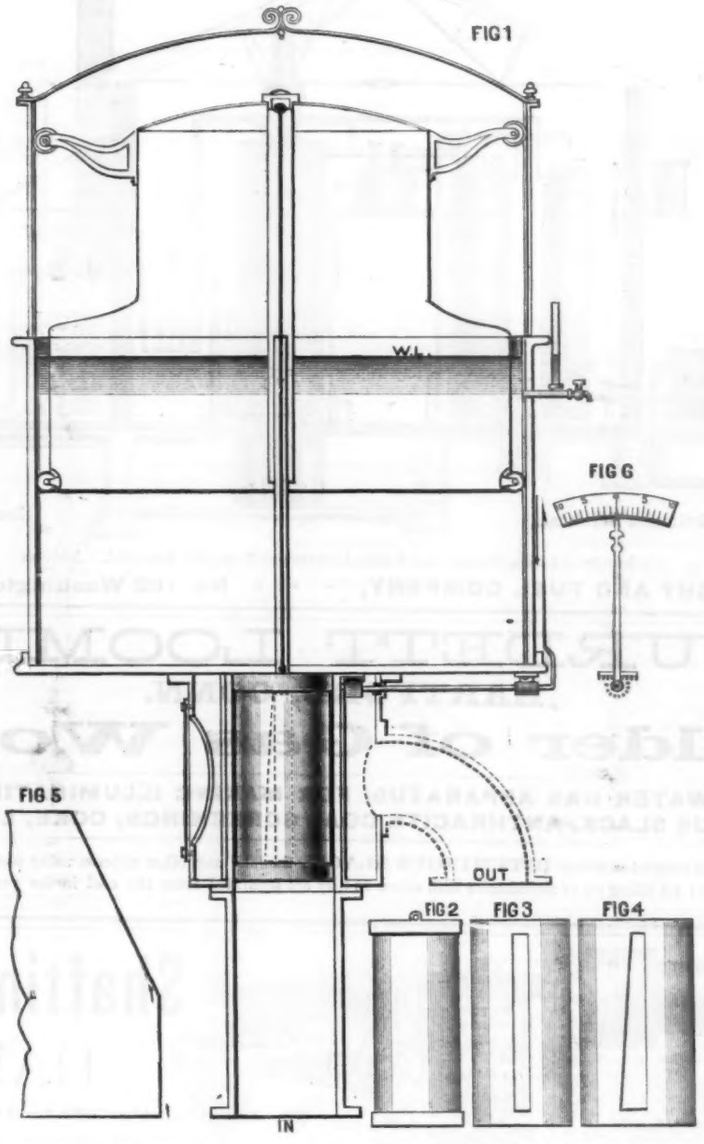
EXCELS ALL OTHERS IN SIMPLICITY, AND COMBINES PERFECT ACTION WITH RELIABILITY.



PRICES ARE Moderate, AND ENTIRE SATISFACTION IS Guaranteed.

The Governor illustrated above, while similar to those in general use, differs in its action, as the bell (or holder) is of different shape—the object sought being a *differential* pressure to meet exactly the output of gas during the hours of consumption at all seasons. It will do this *without* the aid of weights, and is *entirely automatic* in its action. When the demand for gas increases the bell lowers, and in its descent opens the valve and *increases* the pressure simultaneously. When the demand is lessened the bell rises, partially closing the valve and *diminishing* the pressure. The sleeve [fig. 4] is a very valuable adjunct, as by it the ports (or gas-ways) in valve casing [fig. 3] can be lessened at will, so as to adjust the openings to any desired output of gas for winter or summer consumption a feature found in no other Governor. The bell (or holder) can be adapted to any form of valve at present in use.

Circulars, with full description, will soon be sent to all gas companies, and to all others requesting them.

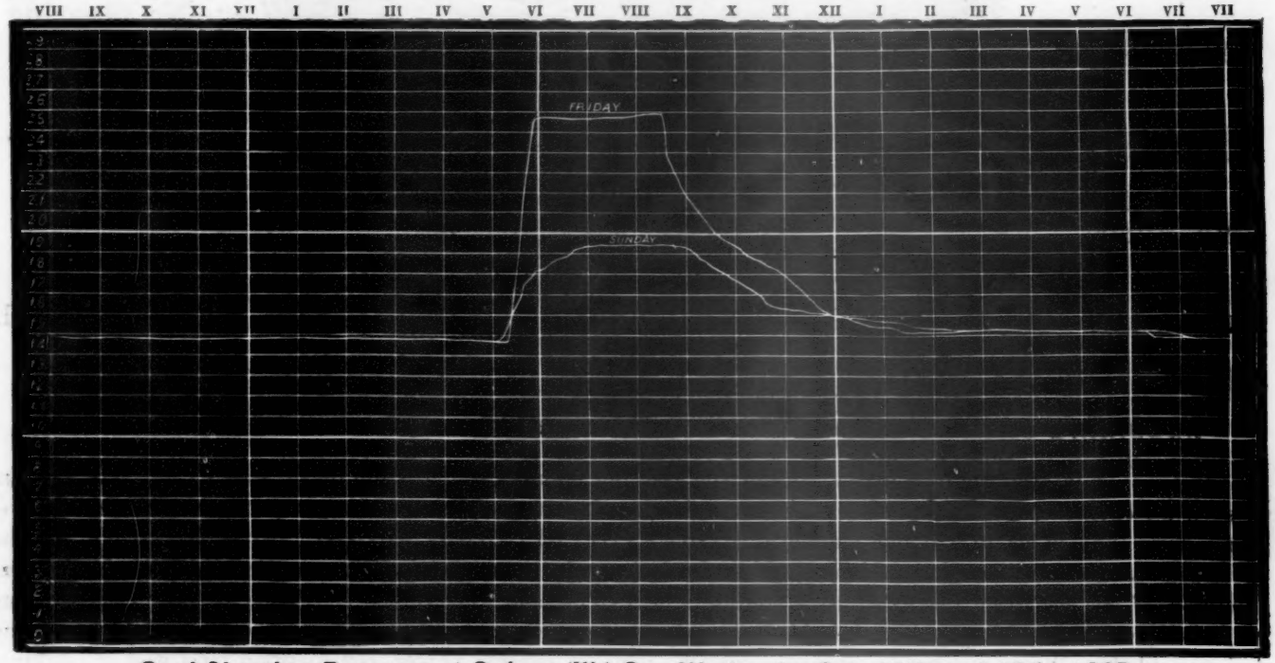
T. C. HOPPER, - - - Arch and 22d Streets, Philadelphia, Pa.

CONNELLY'S AUTOMATIC GOVERNOR FOR STREET MAINS.

We give herewith a few late letters from gas companies using our Governor, and also a cut (exact reproduction) of two pressure sheets from the Quincy (Ill.) Gas Works. A careful inspection of the cut will reveal more concerning the Governor's accuracy and reliability than we could express in all the columns of the JOURNAL. It shows clearly that the Governor is endowed with more than human intelligence, and fully verifies a late remark of a certain "Western Member"—"Connelly's Governor is *brains in iron.*" At Quincy the stores close early, and on all week nights excepting Saturday the Governor begins to reduce the pressure at about 8:30 P.M.; but on Sunday evening (when the consumption is so light that the Governor puts on only 19-tenths pressure) it is *one-half hour later* beginning to reduce—its action being the reverse of that followed by nine out of ten intelligent managers under the same circumstances or conditions. Although the consumption is much less on Sunday nights than on others, the volume per hour remains the same until 9 o'clock, when the church lights are extinguished. The Governor thus shows a finer discrimination than human intelligence is capable of. We do not boast of what our Governors "can" or "will" do, but submit evidence of WHAT THEY ARE DOING! We now have 43 of these machines in practical operation, and experience has taught us that a machine so delicate and sensitive in its construction, liable to be placed under such widely varying conditions, *cannot be perfected on paper.* Our late improvements enable us to send out a Governor to *any works*, capable of being adjusted to any possible conditions or requirements after it is in place. A 20-inch Governor can be sent to one works and adjusted to hold 3-tenths day and 40-tenths night pressure, and its duplicate or counterpart may be sent to another works having same consumption and initial pressure, and be set to hold 10-tenths day pressure and 11-tenths night pressure—both working perfectly as desired. Such range of adjustment is absolutely necessary in an Automatic Governor, not only to secure the desired action in the beginning, but to be prepared to meet the new conditions sure to follow the building of a heavier holder or a large increase in capacity of the mains. No Governor in this country or abroad, in use or illustrated on paper, is constructed with such a range of adjustment, and to secure it would require a radical change in principle.

Another important feature of our Governor *not found in others* is the *absolute impossibility of the valve sticking in its seat* and shutting off the gas. We do not permit the valve to *enter* its seat; it is so constructed that it bears at *right angles* on a knife-edge seat, and must fall away from it when its supporting pressure is reduced in the least degree. The great value of this feature will impress itself on the careful Gas Manager. In short, our experience has enabled us to meet every possible requirement in Automatic Governors (as the accompanying letters attest), and we can unhesitatingly guarantee every Governor sent out to give perfect satisfaction in every respect, or will remove same at our expense. It is useless for us at this late day to waste any words on the *economy* and *satisfaction* derived from such a machine; and no progressive Engineer or Superintendent would to-day plan a works without locating an Automatic Governor. As they are finely finished and highly ornamental, their proper place is in the Office or Meter Room. As one of these Governors will *save its cost* in a short time, no company should hesitate to place one. The more perfect distribution and satisfaction given consumers are additional advantages that cannot be estimated in dollars and cents. We publish below a few letters, and will publish others in the following numbers of the JOURNAL.

CONNELLY & CO., Ltd., 407 Broadway, N.Y.



Card Showing Pressure at Quincy (Ill.) Gas Works, for Oct. 16th and 18th, 1885.

Quincy, Ill.

QUINCY GAS LT. AND COKE CO., QUINCY, ILL., Oct. 21, 1885.

Messrs. CONNELLY & CO.—Gentlemen: Yours of 27th is at hand. You are at liberty to use the pressure sheets in the way you wish, and also my name in testifying to the merits of the Connelly Governor, as *I cannot say too much in its praise.* Yours very truly, A. W. LITTLETON.

Long Island City, N. Y.

EAST RIVER GAS LT. CO., LONG ISLAND CITY, N. Y., Nov. 11, 1885.

Messrs. CONNELLY & CO.—Gentlemen: Replying to yours of 10th inst., I would say that the 16-inch Governor furnished by your firm has afforded me infinite relief from the anxiety always felt regarding conditions of pressure in our mains. Heretofore we have had to rely upon such humanity as is generally found about all medium-sized gas works—the reliability of which most men connected with the gas business are familiar with; but now we have become perfectly satisfied that when any demand is made, either day or night, let it be large or small, it will be instantly met. Behind our Governor we carry full holder pressure—52-tenths; before it our minimum pressure is 15-tenths, and the maximum 30-tenths. We allow the Governor to govern us, and find that our rules have been altered by it. It takes off pressure sometimes as early as 9 o'clock, giving the varying pressure needed until, at 12:30, it stands at the minimum point. On Sunday night it elects to give us only 20-tenths, instead of maximum 30-tenths; and it is allowed to do so, as its judgment of what is needed is perfect. Close watching during a storm will convince anyone how sensitive it is, and how quickly it answers the varying conditions caused by the wind, and by its watchfulness always maintaining a steady, even pressure at the point required. In fact, the instrument is far in advance of any other used for a like purpose that I know of.

Yours truly, C. A. KITTLE, General Manager.

Cleveland, Ohio.

PEOPLES GAS LT. CO., CLEVELAND, OHIO, Nov. 9, 1885.

Messrs. CONNELLY & CO., LTD.—Dear Sirs—Yours of the 6th came duly to hand. With reference to the Governor, in view of my short experience with it (only about three weeks) perhaps I ought to be modest in expressing an opinion; but from the standpoint of experience I feel justified in saying *it does its work perfectly.* Cards are at the works, or would enclose some to you. Will let you have them when you come this way. Meantime I am

Very truly yours, EDWARD LINDSLEY, Eng. and Supt.

Athens, Ohio.

ATHENS GAS LT. CO., ATHENS, OHIO, Nov. 9, 1885.

Messrs. CONNELLY & CO.—Gentlemen: Your favor inquiring after the working of the Connelly Governor received. It has now been in use more than a year, and we find it as recommended in every particular. It does all the work required of a Governor, and strictly *automatically.* I have not the first disadvantage to suggest, after a trial at all seasons of the year. We consider this investment the most profitable and economical of any about our works, and have recommended it to all inquirers. Our leakage account has been reduced one-half. Yours very truly, C. H. WELCH, Supt.

Beaver Falls, Pa.

BEAVER FALLS GAS CO., BEAVER FALLS, PA., Nov. 9, 1885.

Messrs. CONNELLY & CO.—Gentlemen: It affords me no little pleasure to reaffirm that in my opinion no gas works is by half complete that lacks the advantages to be derived from an Automatic Governor such as yours has proved to be after more than a year's steady work—with positively no attention but oiling. The second Governor we purchased of you will shortly be placed in 6-inch line supplying the town of New Brighton.

Hastily yours, J. M. CRITCHLOW, Supt.

THE CLERK GAS ENGINE.

Highest Award, American Institute, New York, 1883. Silver Medal American Institute, N. Y., 1884.
Gold Medal Awarded Crystal Palace Electrical Exhibition, London, 1882.
Highest Award for Motive Power British Section International Exhibition of Electricity, Paris, 1881.

Reliable.

No Boiler.

Steady.

No Coal.

Simple.

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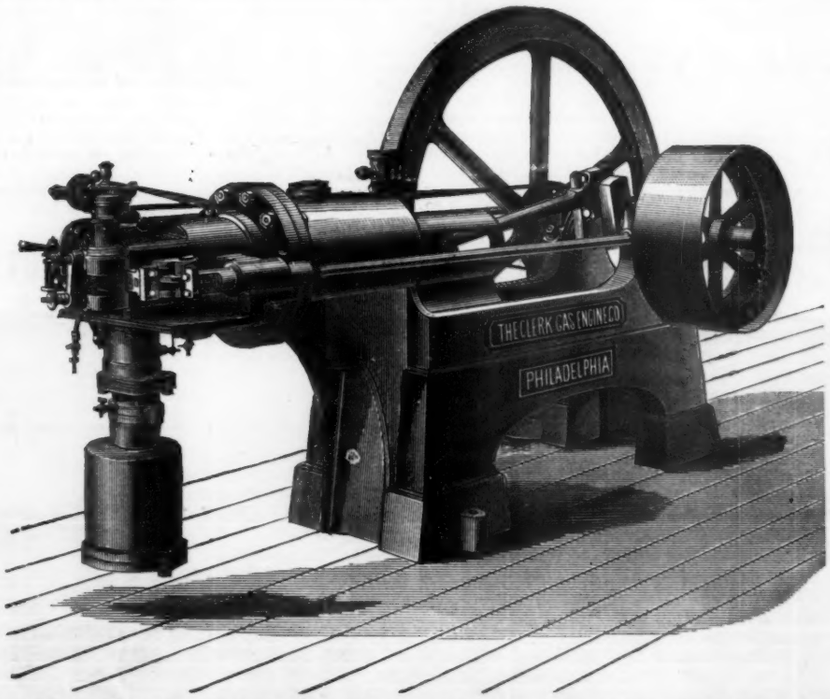

Economical.

No Engineer.

No Explosion

No Gearing Wheels.

No Danger.

No Parts requiring frequent renewal.

REQUIRING ONLY A MATCH TO START IT--GIVING ITS FULL POWER IMMEDIATELY.

We would inform the public that during the last few months we have improved THE CLERK GAS ENGINE to such an extent that we can now offer an engine vastly superior to our former pattern. These improvements have enabled us to sell our engine at a GREATLY REDUCED FIGURE, partly on account of the decreased weight (our engine weighing about half that of others giving the same Brake H. P). The consumption of gas has been decreased to a considerable extent, and the Brake H. P. has been increased some 25 to 30 per cent. All parts of the old design that were considered defective have been remodeled and new designs added. We now have an engine second to none as regards power, consumption, and ease of working. With our new engine all trouble in starting has been removed, the noise reduced to a minimum, and the regularity of motion is now all that can be desired. We guarantee all we claim for it, and the material and workmanship being of the best, enables us to guarantee the engine for twelve months.

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THE CLERK GAS ENGINE CO.,

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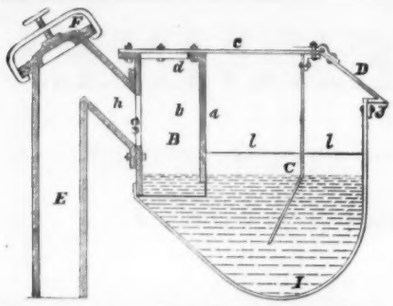

Boardman Hydraulic Main,

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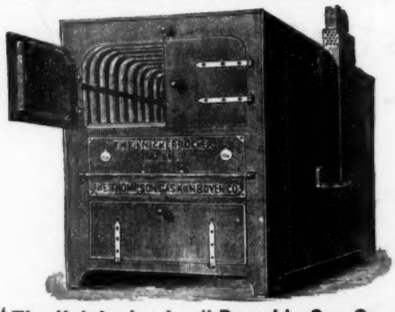
For description, see AM. GAS LIGHT JOURNAL of Feb. 2, 1884.
For terms, apply to

A. E. BOARDMAN, Macon, Ga.



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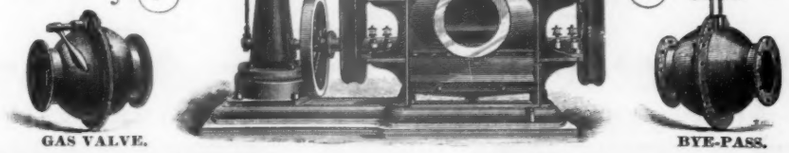

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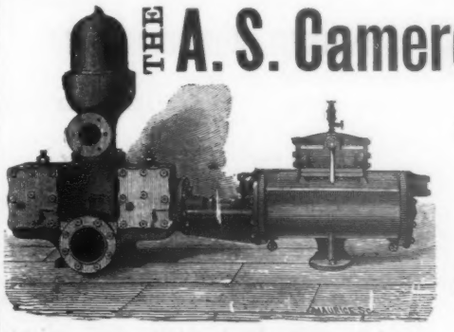

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Gas Furnaces for Tinmen's use; Furnaces for melting Solder and Type Metal; Apparatus for bending Carriage Panels (in successful operation in Carriage Manufactories); Water Heaters for Kitchen Boilers, Baths, etc., and for attaching to Heating Coils and Pipes for Conservatories.

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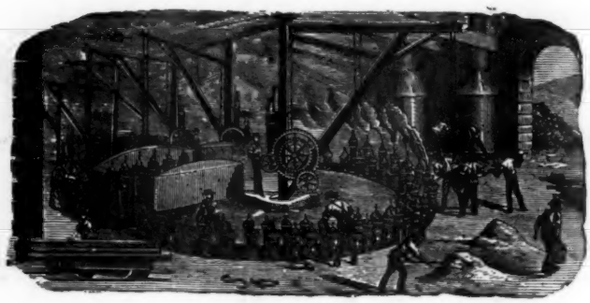

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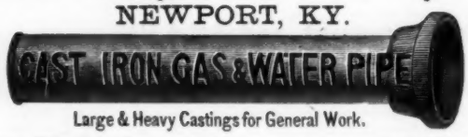

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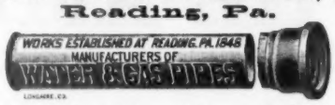

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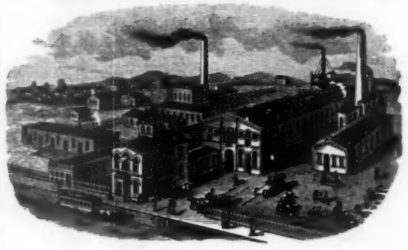

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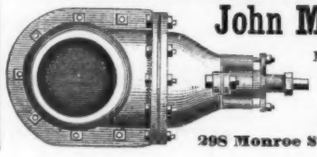

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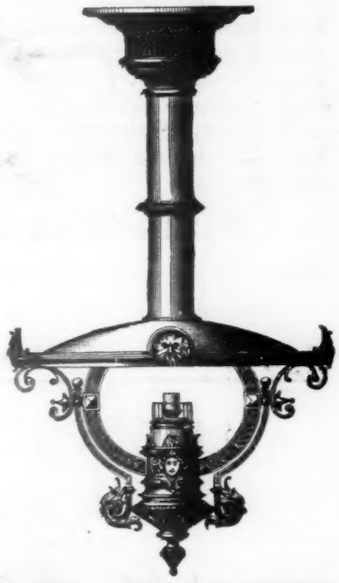
JOHN KIEFER, - - - 344 Lawrence, Street, Denver, Col.



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Total Capacity per 24 Hours of "Standard" Washers Ordered During the Following Years.

1877	4,000,000	cubic feet.
1878	4,750,000	"
1879	24,545,000	"
1880	42,967,500	"
1881	36,462,500	"
1882	39,300,000	"
1883	57,735,000	"
1884	26,177,500	"
Total	235,937,500	cubic feet.

Total Number and Capacity per 24 Hours of "Standard" Washers Erected and in Course of Erection in the Several Countries

	Number.	Cubic Feet per Day.
Great Britain	151	157,070,000
Western Hemisphere	38	39,387,500
Australia	18	12,150,000
New Zealand	2	650,000
France	6	4,550,000
Belgium	8	5,420,000
Germany	16	8,200,000
Holland	4	4,160,000
Denmark	1	150,000
Russia	2	3,500,000
Spain	1	850,000
India	1	400,000
Total	248	235,937,500

THE CONTINUED POPULARITY

Of these Machines

Will be recognized from the following extracts from letters from representatives of some of the companies having them in use:

OFFICE METROPOLITAN GAS CO, N. Y. CITY.

We have had the "Standard" Washer Scrubber you furnished to us in action since August, 1882. The ammonia liquor derived from it has a strength of from 12 to 20 oz. Twaddle, and it works uninterruptedly and satisfactorily.

OSCAR ZOLLIKOFFER, Prest.

Dr. E. G. Love, official Gas Examiner for New York city, reported Metropolitan gas for quarter ending June 30th, 1885, as follows: Illuminating power, 25.04; ammonia, grains in 100 cu. ft., 2.46.

LACLEDE GAS WORKS,
ST. LOUIS, Mo. Nov. 25, 1884.

The "Standard" is performing its work to our entire satisfaction. It has passed and freed from ammonia 30 per cent. more gas than it was rated as being able to pass. The test paper shows not a trace of ammonia.

FREDERIC EGNER, Eng. and Supt.

"Standard" Washers Ordered Recently.

	Cu. Ft. per Day
Anneberg Gas Co.	200,000
Bombay Gas Co.	400,000
Brussels Co.	1,250,000
CHICAGO, two, 1,000,000 each	2,000,000
Chemnitz Gas Co	1,000,000
CITIZENS GAS CO., BUFFALO	750,000
Coke Works in Zabre, Ober-Schlesien	1,500,000
Cokerei der Friedenshutte, Upper Silesia	100,000
Dumfries Corporation	250,000
Dunedin Gas Co., New Zealand	400,000
GEORGETOWN, D. C.	250,000
King's Lynn Gas Co.	300,000
Leiden, Holland	600,000
Lincoln Gas Co.	400,000
Liverpool Gas Co.	2,000,000
" "	3,000,000
LOUISVILLE GAS CO.	1,500,000
MUTUAL GAS CO., BUFFALO	750,000
MINNEAPOLIS GAS CO.	1,000,000
Numea Gas Co.	100,000
PITTSBURGH GAS CO.	1,500,000
PAWTUCKET, R. I.	500,000
PORTLAND GAS CO., Oregon	562,500
SAN FRANCISCO GAS CO.	4,000,000
Sheepbridge	40,000
ST. LOUIS GAS CO.	2,000,000
Sydney Gas Co.	2,500,000
WASHINGTON, D. C. GAS CO.	2,000,000
Whitchurch Gas Co	175,000
Total	29,677,500

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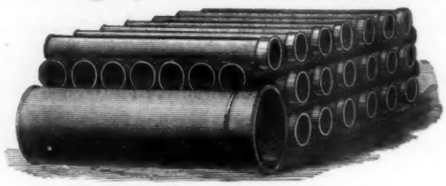
Cast Iron Pipe, Fire Hydrants, Eddy Valves, Lamp Posts, Large Loam Castings, Flanged Pipe, Sugar House Work, Iron Roofs and Floors, Wrought & Cast Iron Tanks, Turbine Water Wheels and Pumps.



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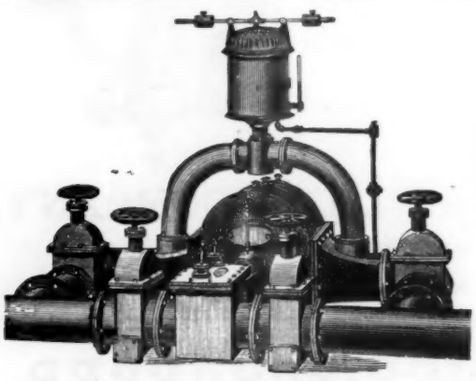

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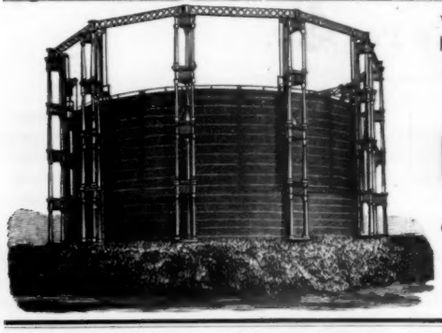

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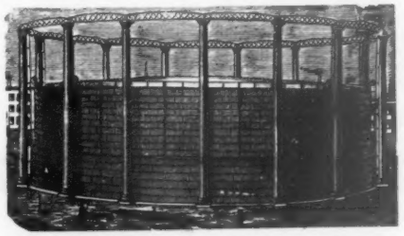

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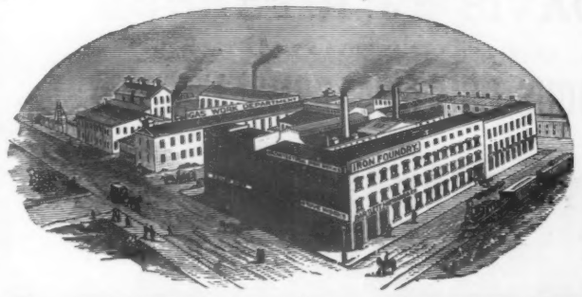

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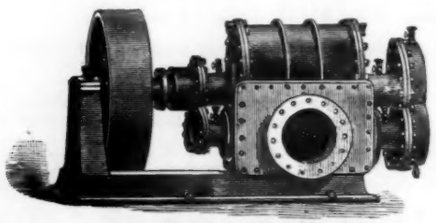

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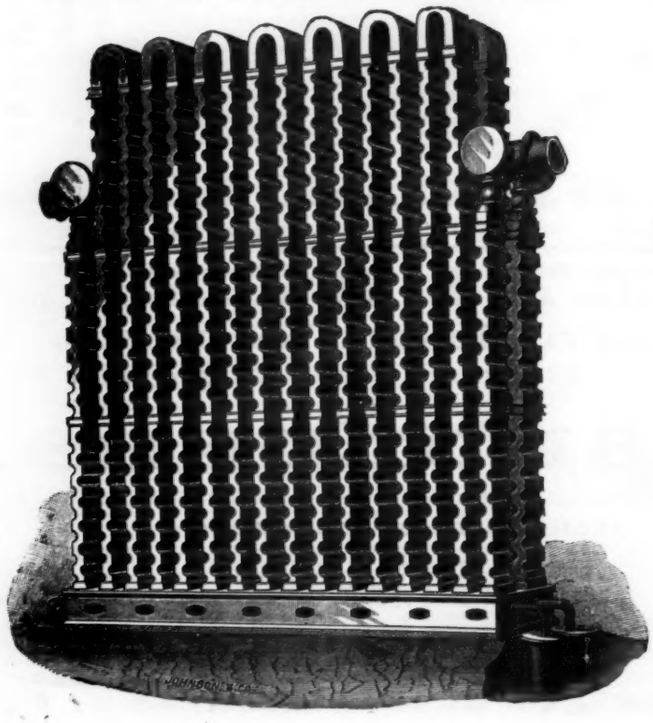

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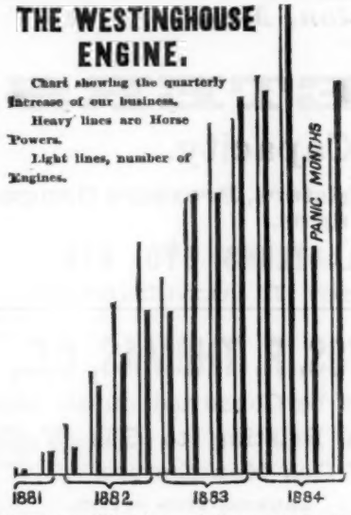

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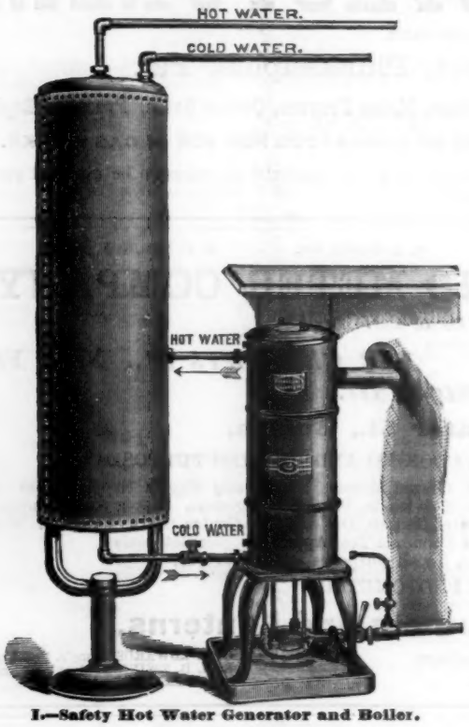
"SUN DIAL" GAS STOVES

The Most Economical, Efficient, and Durable Gas Stove Made.



I.—Safety Hot Water Generator and Boiler.

II.—Gas Cooking Stove No. 8 B.

Safety Hot Water Generator and Boiler.

Cut I. represents our Safety Gas Hot Water Generator and Boiler, arranged for home use. This most easy, quick, and economical way of preparing a warm bath, or for heating water for any omestic purpose, entirely supersedes any necessity for the use of ranges or stoves—a great comfort, particularly in hot weather. The boiler being self-filling, as the hot water is drawn off, can never become empty, thus preventing the possibility of any accident.

We beg to call attention to the cast iron pan which is now attached to the legs of the Generator (see illustration). This is to catch the drippings from the Coil, which many persons suppose come from a leak, when in fact they are produced by condensation. This condensation is caused by the hot flame coming in contact with the coil filed with cold water.

New Style Gas Cooking Stove.

Cut II. represents our New Style Cooking Stove. As will be seen, it has an ornamented cast iron base and front, and extension shelves. The oven burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent applied for). The ovens are of greater capacity than those of the old style. The top, in conjunction with the outlet pipe, is designed to carry off all products of combustion; hence the outlet pipe must be connected with a flue, or the stove will not work properly.

This Stove has 4 boiling burners in top of hot plate. All fittings are nickel plated. We are making this style of Cooking Stove in the following sizes—viz., No. 7 B, No. 8 B, No. 9 B, and No. 10 B.

III.—Improved Hot Plate, No. 108.

New Style Hot Plates.

Cut III. represents our New Style of Hot Plates, of which we are making No. 106 (two small boiling burners), No. 107 (two medium sized boiling burners), and No. 108 (two medium and one large boiling burner). See new Catalogue and Price List for further particulars.